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Hi-Fi Infirmary

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HI-FI INFIRMARY

A graduate project submitted to Dakota State University in partial fulfillment of the requirements for the degree of

Master of Science

In

Information Systems

December, 2010

By

Sandeep Kumar Lakkaraju

Project Committee:

Chair: Dr. Ronghua Shan

Member: Dr. William Figg

Member: Dr. Mark Moran

PROJECT APPROVAL FORM

We certify that we have read this project and that, in our opinion, it is satisfactory in scope and quality as a project for the degree of Master of Science in Information Systems.

Student Name: Sandeep Kumar Lakkaraju

Master's Project Title: Hi-Fi Infirmary

Faculty supervisor: Ronghua Shan Date: 12/14/10

Committee member: Mark Mon Date: 12/14/10

Committee member: Date: 12/15/10

ACKNOWLEDGMENT

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I would also like to extend my heartfelt gratitude to my committee members, Dr. William Figg and Dr. Mark Moran whose encouragement, guidance and support from the initial to the final level enabled me to develop an understanding of the subject. The associated experience broadened my perspective on the practical aspects in the industry.

I would regret my graduate years had I not joined Dakota State University. Joining DSU was not only a turning point in my life, but also a wonderful experience. Furthermore I would like to thank our Dean, Dr. Omar El-Gayar who has always been a constant source of encouragement during my graduate study. I would also like to thank Dr. Sreekanth Malladi, under whom I worked as a graduate assistant for two years. Dr. Malladi is very supportive, and encouraging. I will treasure these precious moments I have shared with the faculty, staff, and friends especially my roommates at Dakota State University.

My deepest gratitude goes to my family for their unflagging love and support throughout my life. I am indebted to my father, L.V.R. Murthy for his care and love. As a typical father from an Indian family, he worked industriously to support the family and spare no effort to provide the best possible environment for me to grow up and attend school. He had never complained in spite of all the hardships in his life. I cannot ask for more from my mother, S.L. Parvathi, as she is simply perfect. I have no suitable word that can fully describe her everlasting love to me. Mother, I love you. I would also like to mention about my brother and friend L. Santhosh Kumar for times we had spent together and had fun. Last but not least, thanks to God for my life through all tests in the past two years. You have made my life more bountiful. May your name be exalted, honored, and glorified.

ABSTRACT

In present situation lot of hospitals maintains patients' personal data either by using manual records or by using computers. But they are not providing any online interface to the practitioners to view patients' details like test reports, deceases etc. To avoid this situation and to provide online communication between the practitioners we are introducing a portal called "High-fi Infirmary". This document shows the requirement and functional documentation for High-fi Infirmary. It symbolizes all the needs and the requirements to achieve a quality that is desired for the application and it contains information for the development team to design the application.

DECLARATION

I hereby certify that this project constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions or writings of another.

I declare that the project describes original work that has not previously been presented for the award of any other degree of any institution.

Signed,

___Sandeep Lakkaraju____
<Student name>

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Medical errors became a universal matter, and are occurred because of human factors which can be avoided with computer systems. In order to reduce the increase in medical errors and support practitioner's decision making it is suggested to use clinical decision support systems as an integral part of clinical information and the inference engine must be linked with all the available clinical records.

Statement of the problem

In present situation lot of hospitals maintains patients' personal data either by using manual records or by using computers. But they are not providing any online interface to the practitioners to view patients' details like test reports, deceases etc. To avoid this situation and to provide online communication between the practitioners we are introducing a portal called "High-fi Infirmary". This document shows the requirement and functional documentation for High-fi Infirmary. It symbolizes all the needs and the requirements to achieve a quality that is desired for the application and it contains information for the development team to design the application.

Objectives of the project

This paper attempts to develop an online emergency portal for Meher Hospital, which organizes the data effectively, provides mechanisms to maintain good ambulatory care and accurately process the needs.

LITERATURE REVIEW

Until 1980's it is very difficult to provide either medical support or data transportation on medical expertise to clinicians who are practicing far from the medical center and large hospitals. After performing several efforts in literature decision support system emerged and became reliable and widespread for clinicians. Clinical decision support system is being effectively used for improving quality of healthcare, reducing medical errors. The structure of a clinical decision support system comprises of four parts: Data part, Model Part, Inference part and Human-computer interaction part. The Data part includes a database system, which maintains the patient clinical information data for decision making; The Model part contain medical logic model base and management system; The Inference part contains a set of rules or the knowledge base and the decision support reasoning machine; The Human-computer interaction part acts as the user interface of the clinical decision support system [3].

As there are a lot of clinical guidelines to follow, the possibility of change over time and their dependence on the hospital which uses them make the development process cumbersome and costly. The challenge is to develop a CDSS in a cost effective way. Evidence based medicine integrates the clinical expertise, patient values and the available best evidence in to a decision making process for patient care. Ambulatory care is the most important and emergency care to be offered. Thus, there is every possible need to develop a system which can process the needs based on the rules of emergency. The use of guideline research recommendations in processing the emergency requests from patients is left to the discretion of the physicians. Although the guidelines are usually expressed in natural language, they may conform to a specific structure so the developers represent it in a computer language like UML etc... [2]. In contrast, the performance measures are the standards of the care which imply that physicians are in error if they do not care for patients following the specified standards. Hence performance measures should define how to practically identify those patients for whom a specific action is to be taken.

Coming to the Hi-fi Infirmary (artifact), which is the proposed model, organizes the data effectively and also, it provides mechanisms to communicate information efficiently and

accurately. It provides information regarding ambulance services offered by different hospitals. It is easy to generate reports. A practitioner can access the information quickly. The system is proposed to have the following modules: Administrator module, Employee module and report module. Administrator module: Administrator manages the entire application. Administrator can add, delete, edit and view the employee details. Administrator also manages the doctors' details along with other attendants. Administrator keeps track of ambulances available and their current status. Report module: This module allows one to generate reports based on different criteria such as ambulance details, employee details, patient details, services offered and so on. Employee (Hospital In-charge) module: This module allows employees to register and manage patient details. When a request is made, an employee immediately dispatches an ambulance with available doctor and other attendants. Employee keeps track of patient status and in case of emergency consults a hospital for admitting the patient. Some of the software requirements include apache tomcat 5.5, Oracle, Java/J2EEE, JSP, and some Eclipse. Coming to the hardware requirements, this application can work on any processor which runs of Pentium IV, with 2GB ram with at least hard disk with space of 160GB.

This application is deployed in an easily understandable output screens using web technology. Web pages are developed in such a way that they will facilitate the physicians in understanding the application without any hard work. There are mainly two interfaces available: organizational interface and common usage interface. Where, an organizational interface can be accessed by those who will have some organizational privileges, like administrators. It is used mainly for organizational activities such as insertion, updating, and deletion of data. Whereas the common usage interface will provide support in managing the patient oriented data, and services provided to the patients. Input and output designs are of major concern while designing the system. Crucial concerns with input design are supposed to build cost effective and flawless system [2]. Some of the possible levels considered for data input into the database include: filing of data into the database, validation of data, transmission of data, and correction of data.

SYSTEM DESIGN

System Development is a concept introduced in the late 60s. Its purpose is to impose some framework and structure onto the IS development activities. SDLC decomposes the process of IS development into a set of distinct phases. Each phase involves a set of activities/steps and is to produce a set of deliverables. Phases involved are: Planning (Why build the system?), Analysis (Who, what, when, where will the system be?), Design (How will the system work?), and Implementation (System delivery).

Planning consists of system initiation where business value is identified and feasibility analysis is done. Project management includes developing a work plan, recruiting staff for the project, controlling and directing the project. Analysis includes Identifying user requirements and establishing an accurate model of the problem domain. Design may include physical Architectural design, interface design, database and file design, and program design.

Coming to the popular system development methodologies available, some examples of methodologies include: Structured (Waterfall method, Parallel Development) and Rapid Application Development (RAD) (Phased Development, Prototyping, Throw-away prototyping).

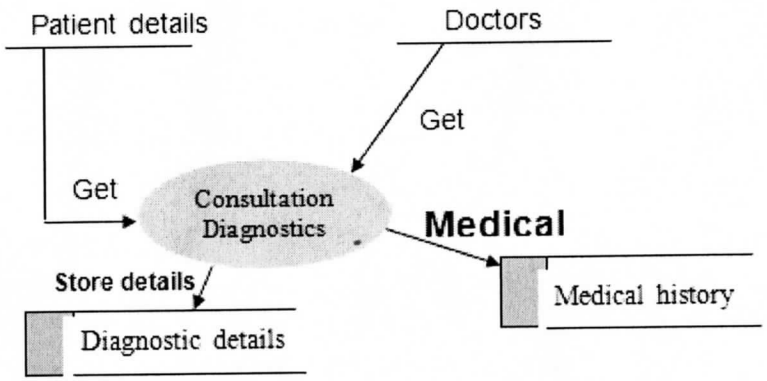

Figure 1: Model of the System

Table 1: Constructs in the Model

Modeling construct	Description
Consultation Person	An actor who processes the requests
Diagnostic Details	Details for the practitioners about the patients
Medical History	A document about the patient's medical history created/maintained by the practitioners
Patient Details	Details such as patient's admission, attending, etc…
Doctors	Details of the doctors who attended the patients

Design is much more creative process than analysis. Design is the first step in the development of any system or product. Design can be defined as "the process of applying various techniques and principles for the purpose of defining a device, a process or a system in sufficient detail to permit its physical realization". It involves four major steps they are

- Understanding how the system is working now.
- Finding out what the system does now.
- Understanding what the new system will do.
- Understanding how the new system will work.

Based on the research, possible system architecture is developed as below:

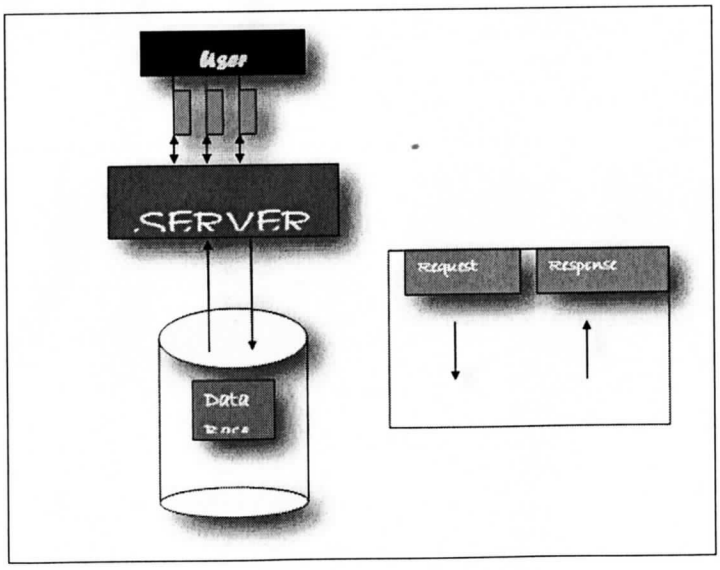

Figure 2: System Architecture

REQUIREMENT ANALYSIS

Software Requirements:

Table 2: Software Requirements

Software/Technology	Description
Operating System	Windows
Technology	Java/J2EE (JDBC, Servlets, JSP)
Web Technologies	HTML, Java Scripts, CSS
Web Server	Tomcat
Additional Software's	J2SDK 1.5, Tomcat 5.5, Oracle 9i

Hardware Requirements:

Table 3: Hardware Requirements

Hardware/Tools	Description
Hardware	Pentium based systems with minimum of P4
RAM	256MB (minimum)
HTML Designing	Dream weaver tool or Visual Web developer
Development Tool Kit	Eclipse
Server	Tomcat

FUNCTIONAL REQUIREMENTS:

The System has been divided into following modules:

a. Admin Module
b. Employee Module
c. Intra - network Module
d. Report Module

a. Admin Module:

This module is designed for hospital administration department, by using this module hospital management can store any patient details who visits that hospital and also they can place all decease report details of each and every patient in this portal so that any patient can view their details by logging in to this portal by using their username and password. This module is having following sub modules.

- Master:

By using this module administrator can store medical practitioners (doctor) details who are working in that hospital and patient fee details who are visiting to that hospital.

- Medical Practitioners:

This module includes information about doctors. It includes name of the doctor, his specialization of medicine, nothing but in which area he is specialized, also his address and finally his identification number is compulsory, this number will be generated automatically.

- Category:

Category system is having full details of the fees structure based on the type of patients.

- Maintenance:

This module helps to maintain the details of the following

- Patient registration:

Registration of patient is very important, which helps to identify the patient with an identification number & easy retrieval of the patient records.

- Consultation:

Consultation holds the details of the patient's history & family history; like physical exam, the investigation, diagnostic etc., this gives the records in detail of patient medical history visit wise. This helps to go through easily the patient's medical history.

- Diagnostic details:

This will hold the details of the patient problem & the related doctors who have taken care of particular patient. He has to follow the schedules given by head of the department. He has to visits wards regularly according to schedule.

- Certificates:

It provides different varieties of certificates generally issued by the diagnostics like fitness, birth, death certificates etc., by showing these certificates doctor finalize that what problem they have & what to do next.

- Ambulance Details: It provides the details of how many and what kinds of ambulances are available, which ones are dispatched, etc.

- Visitor Details:

This is use to maintain the details of the visitors. Visiting hours have to be validated to meet the patients. Here visitors are required to visit the patients only on visiting time that is allocated. In other timings, visitors are not allowed into the premises. If compulsory, then only they are allowed into the premises.

- Delete Patient:

By using this functionality administrator will delete patient details.

b. Employee Module:

By using this module employees can view all patient report details regarding their deceases. Mainly this module is designed for practitioners, getting all decease reports then hospital management will place their report details in the portal so that they can view their details at any time by using login id and password which are provided to them. This module consists following functionalities.

- Patient Details:

By using this functionality any patient can view their basic details which are provided in a hospital.

- Consultation Details:

  By using this functionality patient can view consultation details.

- Diagnostics Details:

By using this functionality patient can view diagnostics details.

- Certificates:

By using this functionality patient can view medical certificate details.

- Ambulance Details: It provides the details of how many and what kinds of ambulances are available, which ones are dispatched, etc.

- Visiting Hours:

By using this functionality patient can view possible visiting hours of a hospital.

- Doctor schedule:

By using this functionality patient can view possible visiting hours of a particular consultant doctor.

- Receipts:

By using this functionality patient can view their billing details.

c. Intra-network Module:

By using this module over all hospital management staff can view the details of doctor-schedule, different type of bills of hospital etc.

- Doctor Schedule:

This is used to maintain the schedules of the doctor to words patient, and appointments, this will be maintained by hospital administrator only which helps to avoid confusion from doctor schedules.

- Receipts:

Depending upon the category the patient is registered the consultation fee is collected & the same amount has to be entered through this receivables screen. The entire incoming amount has to be maintained by submitting through this screen.

- Payments:

Hospital accounts & necessary financial statements can be generated here. It gives the details of the amounts to be paid by the hospital towards electricity bill, telephone bill, building rent, stationary, salaries and miscellaneous expenditure.

d. Reports Module:

By using this module hospital management can maintain reports on various categories. They will maintain different reports on following categories.

- Registrations:

By using this functionality administrator can maintain details of all patients who visited and are admitted in that hospital.

- Receipts:

Depending upon the category the patient is registered the consultation fee is collected & the same amount has to be entered through this receivables screen. The entire incoming amount has to be maintained by submitting through this functionality.

- Payables:

This will take care of your personal accounting & the details of the amounts to be paid by the hospital towards electricity bill, telephone bill, building rent, stationary, salaries & miscellaneous expenditures.

DATA FLOW DIAGRAMS USED

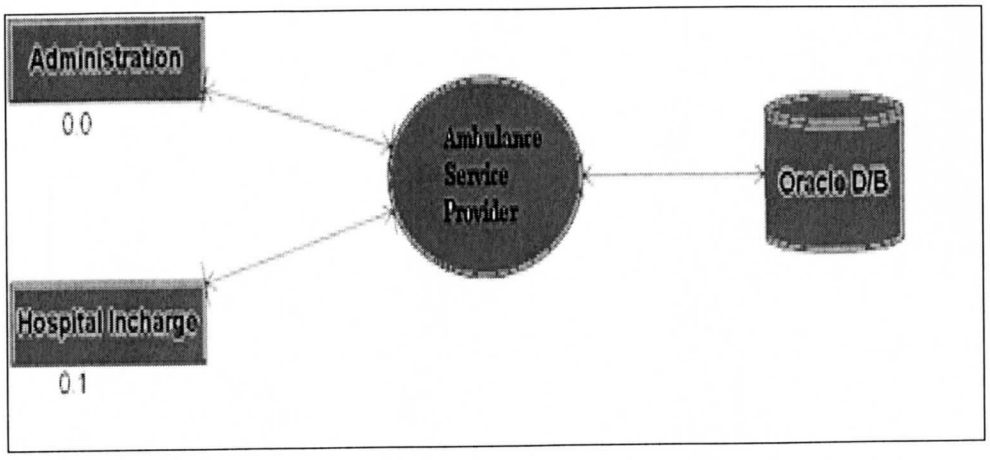

Figure 3: Context Level DFD

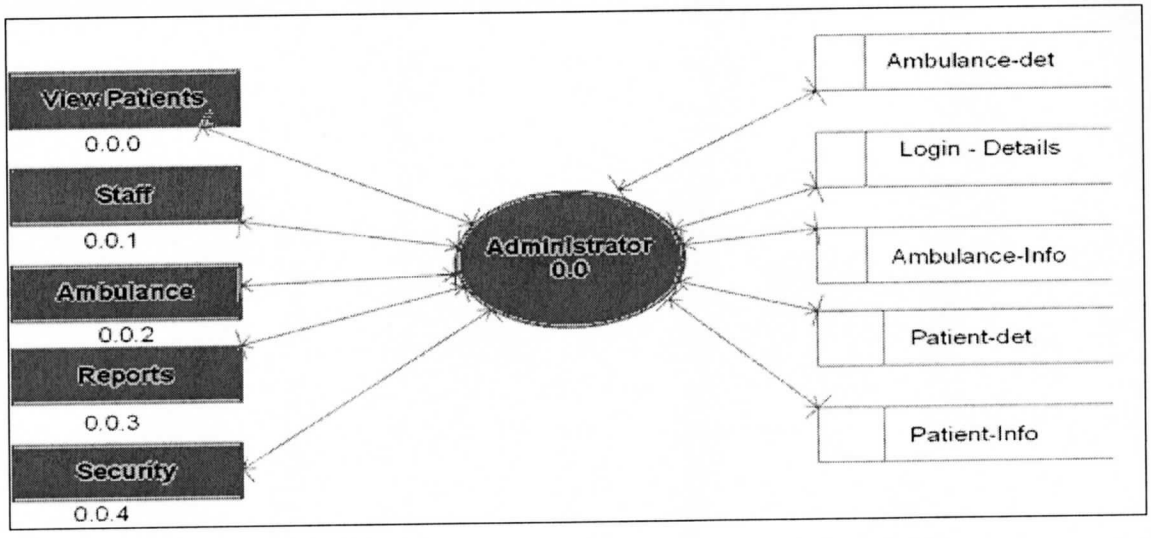

Figure 4: Level 0 DFD for Administration

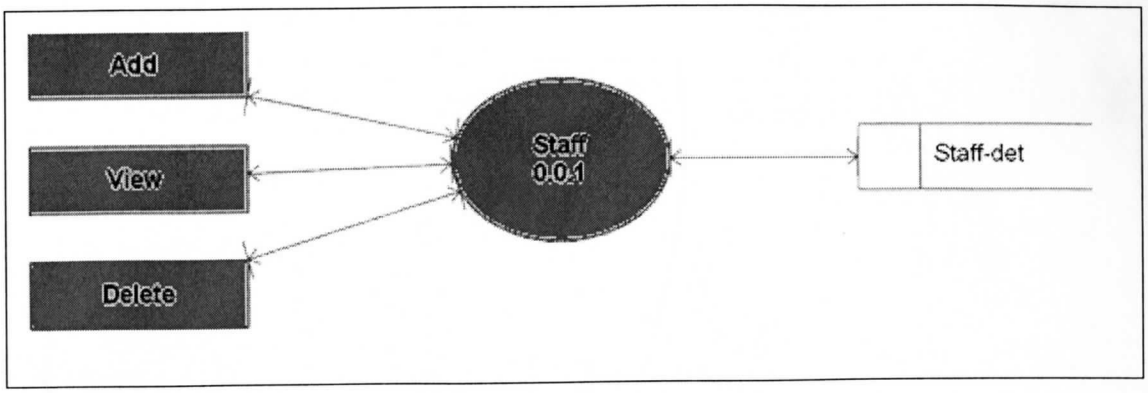

Figure 5: Level 1 DFD for Staff

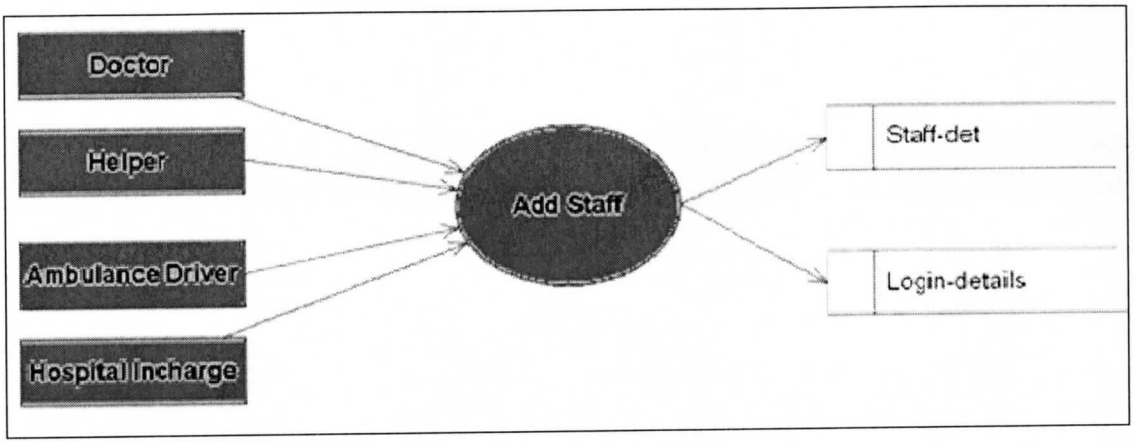

Figure 6: Level 2 DFD for Adding Hospital Staff

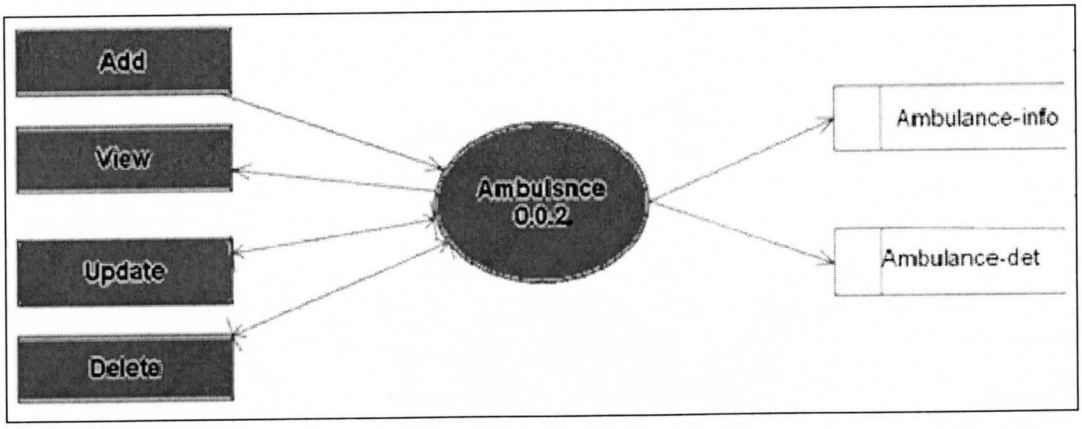

Figure 7: Level 1 for Ambulance of Admin

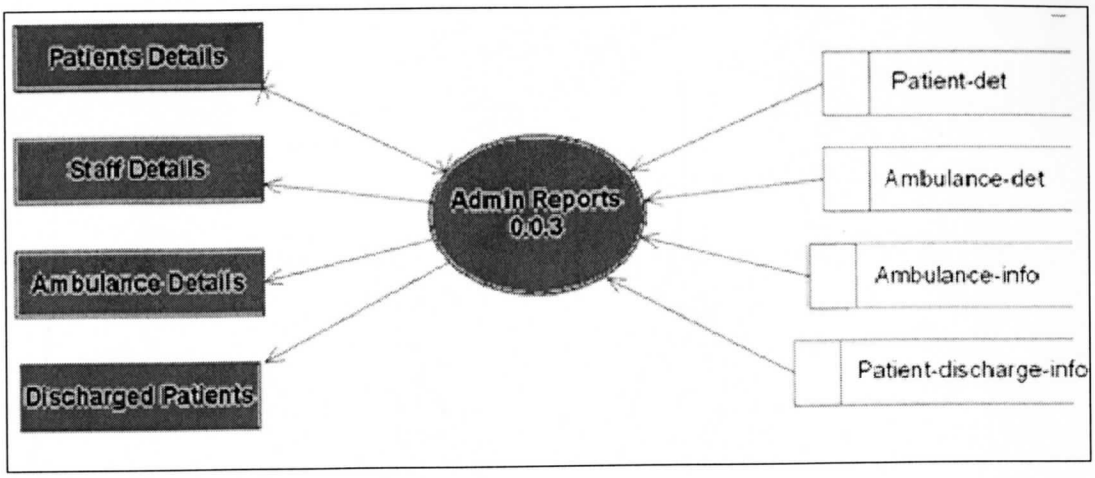

Figure 8: Level 1 DFD for Admin Reports

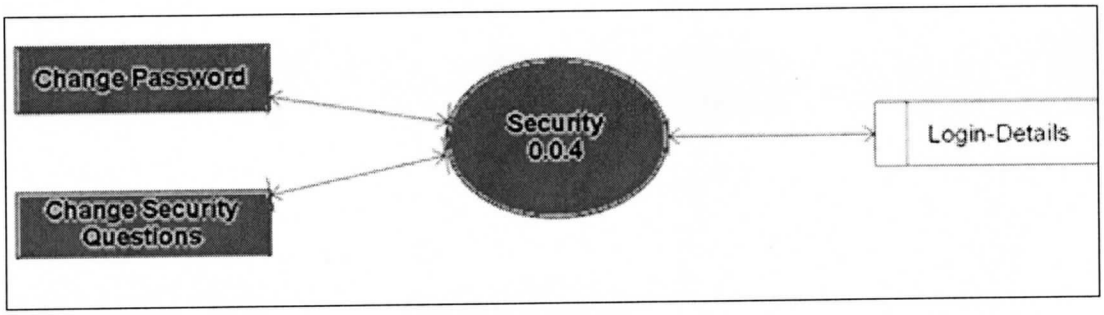

Figure 9: Level 1 DFD for Security of Admin

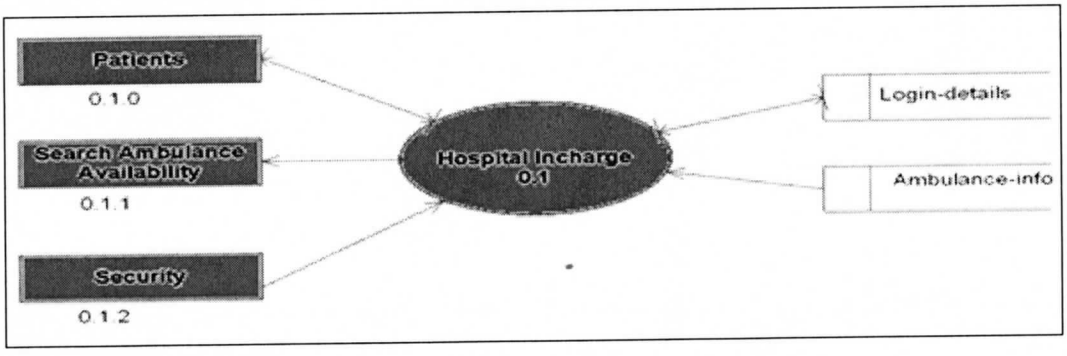

Figure 10: Level 0 DFD for Hospital In charge

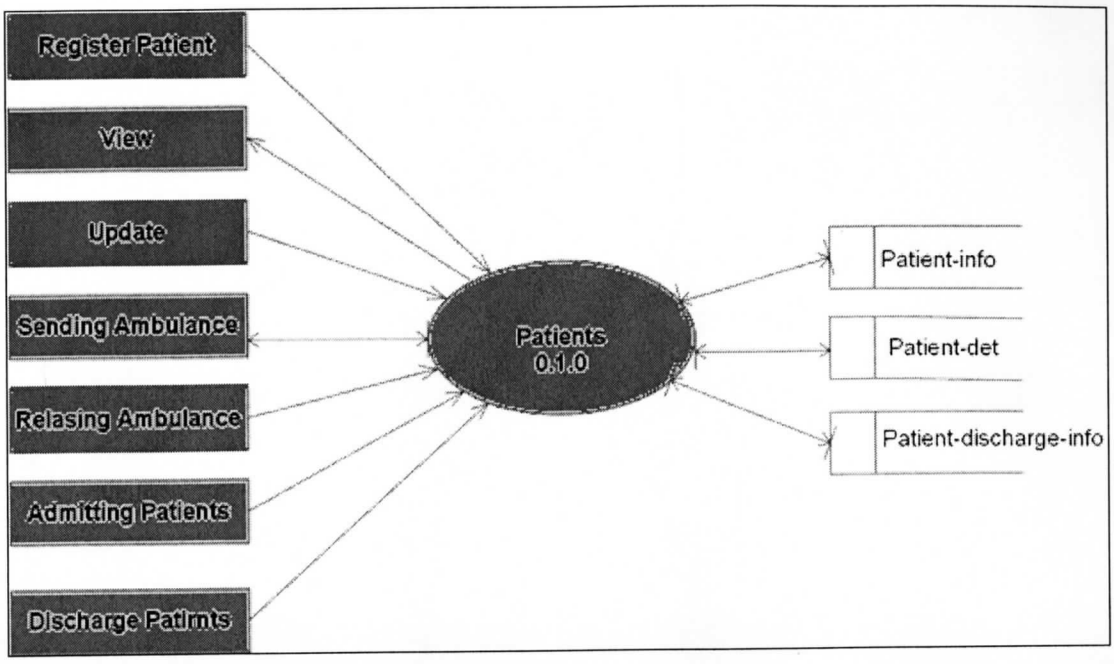

Figure 11: Level 1 DFD for Patients Details

UML DIAGRAMS USED

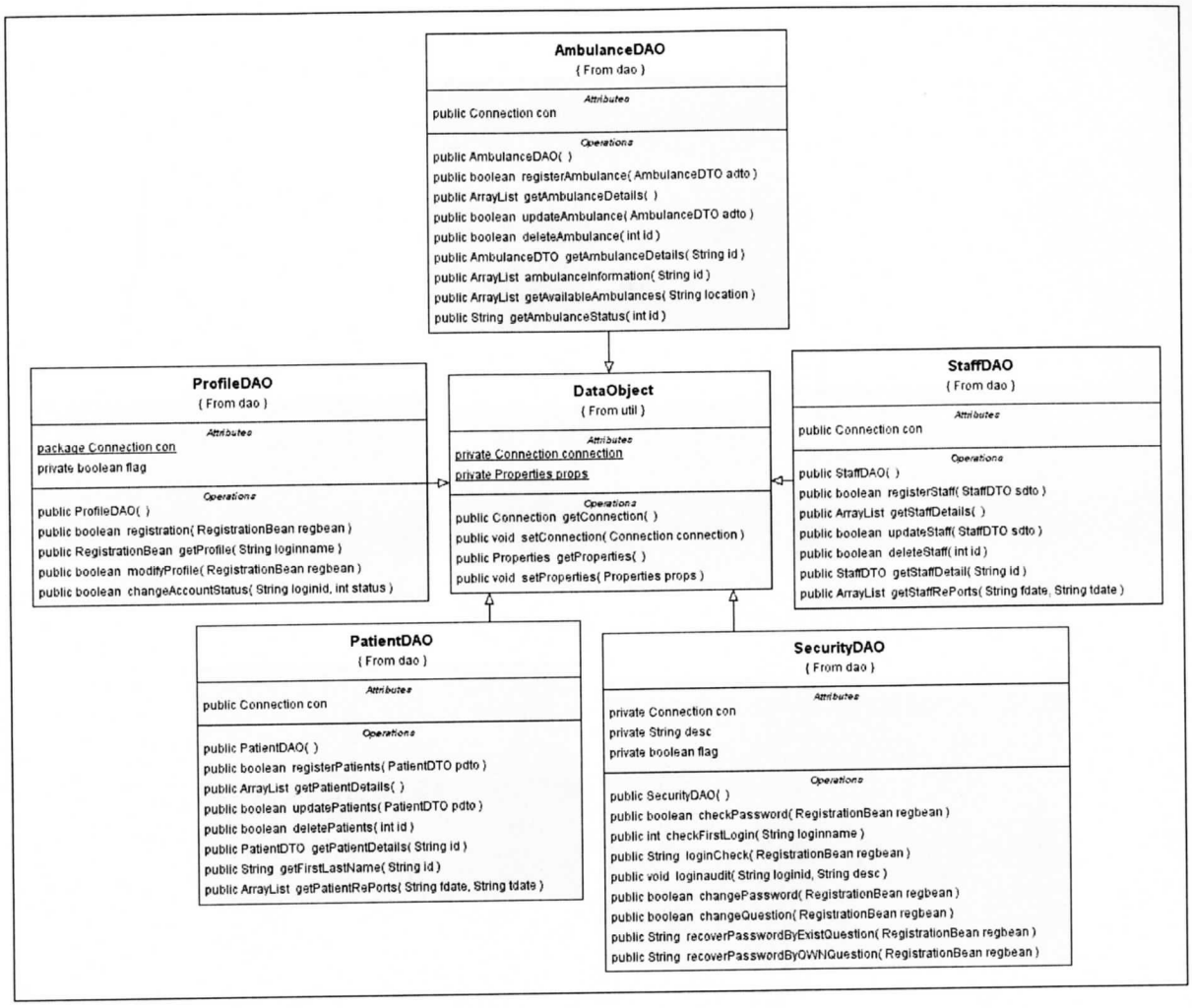

Figure 12: Class Diagram 1

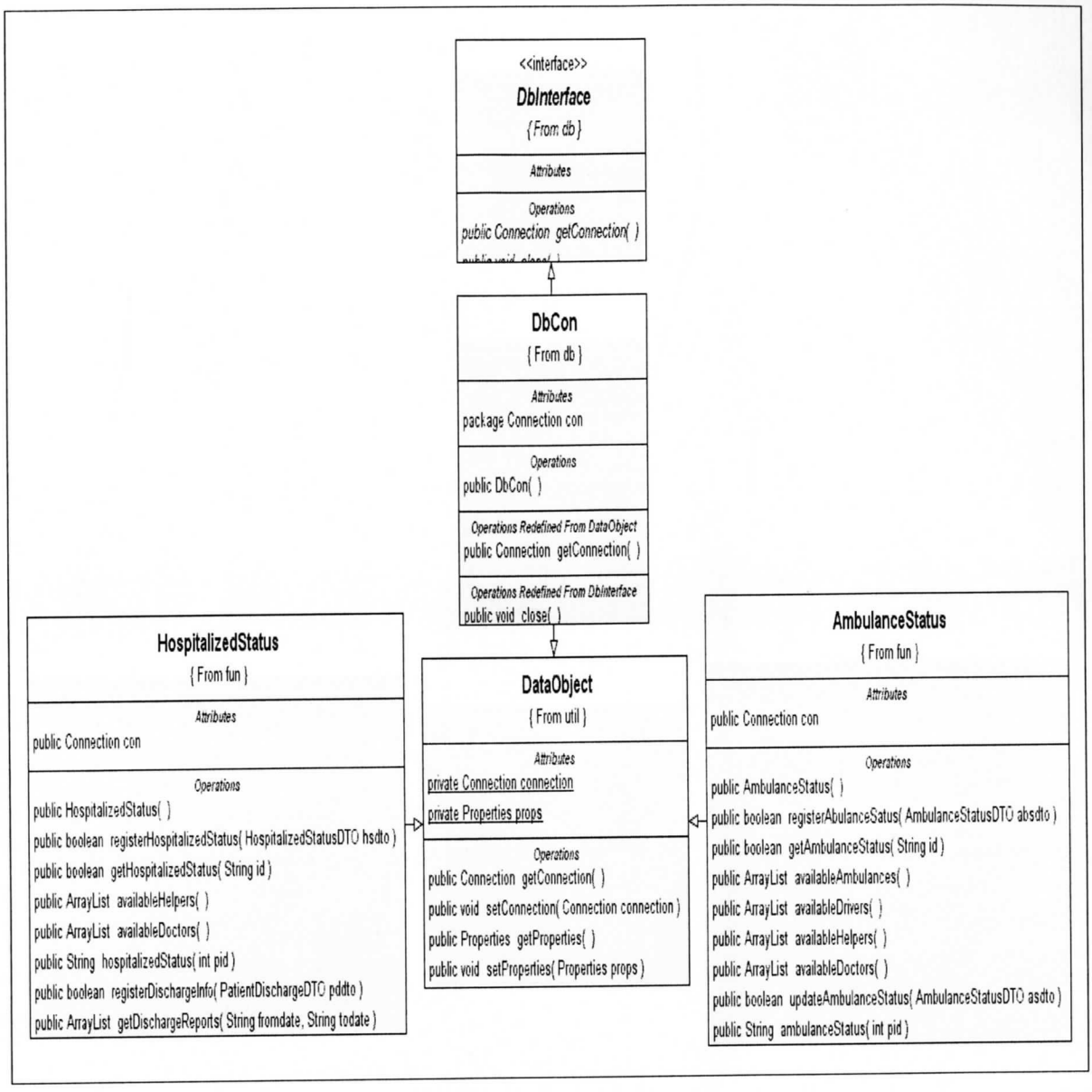

Figure 13: Class Diagram 2

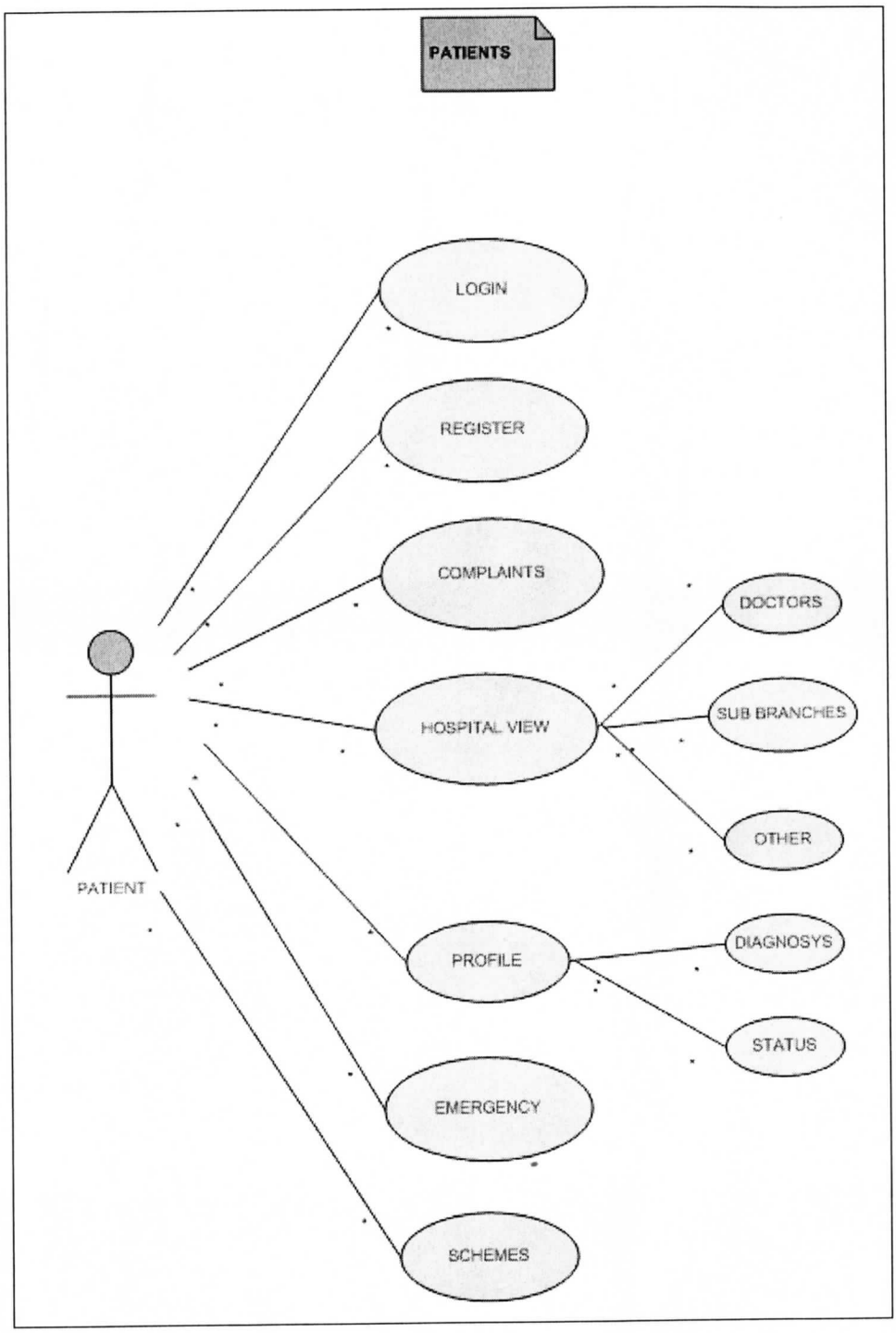

Figure 14: Use case Diagram for Patient

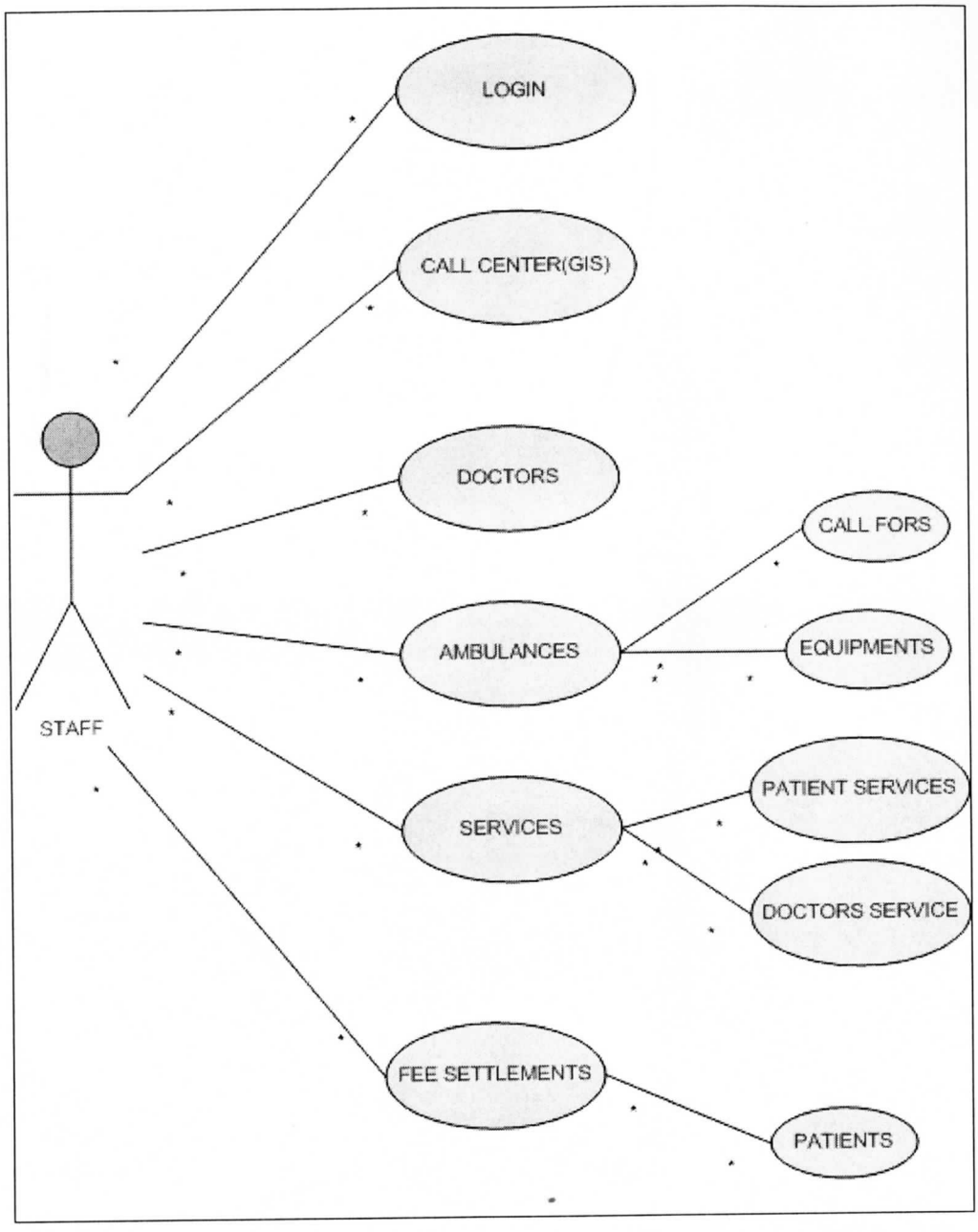

Figure 15: Use case diagram for Staff

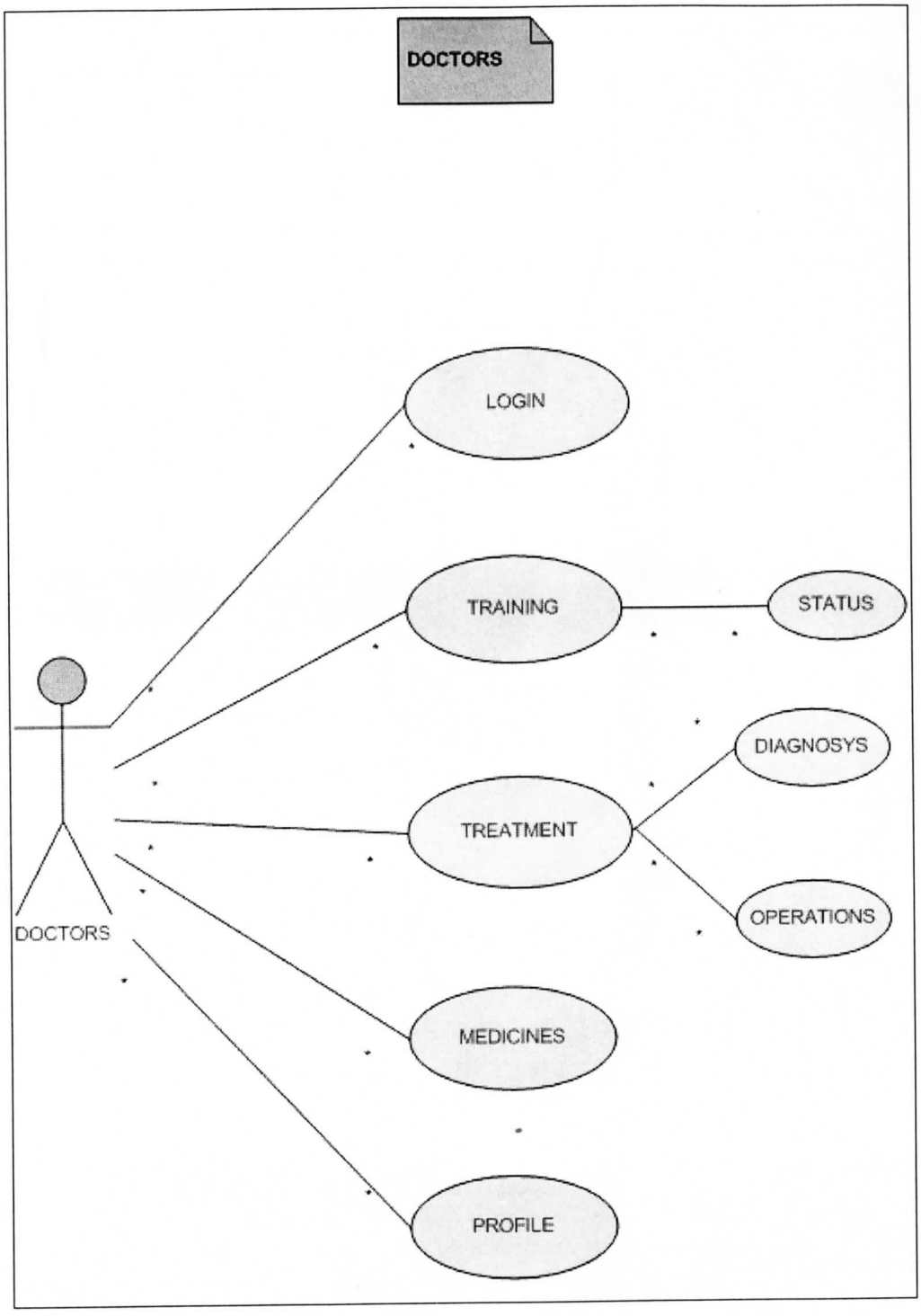

Figure 16: Use case Diagram for Doctors

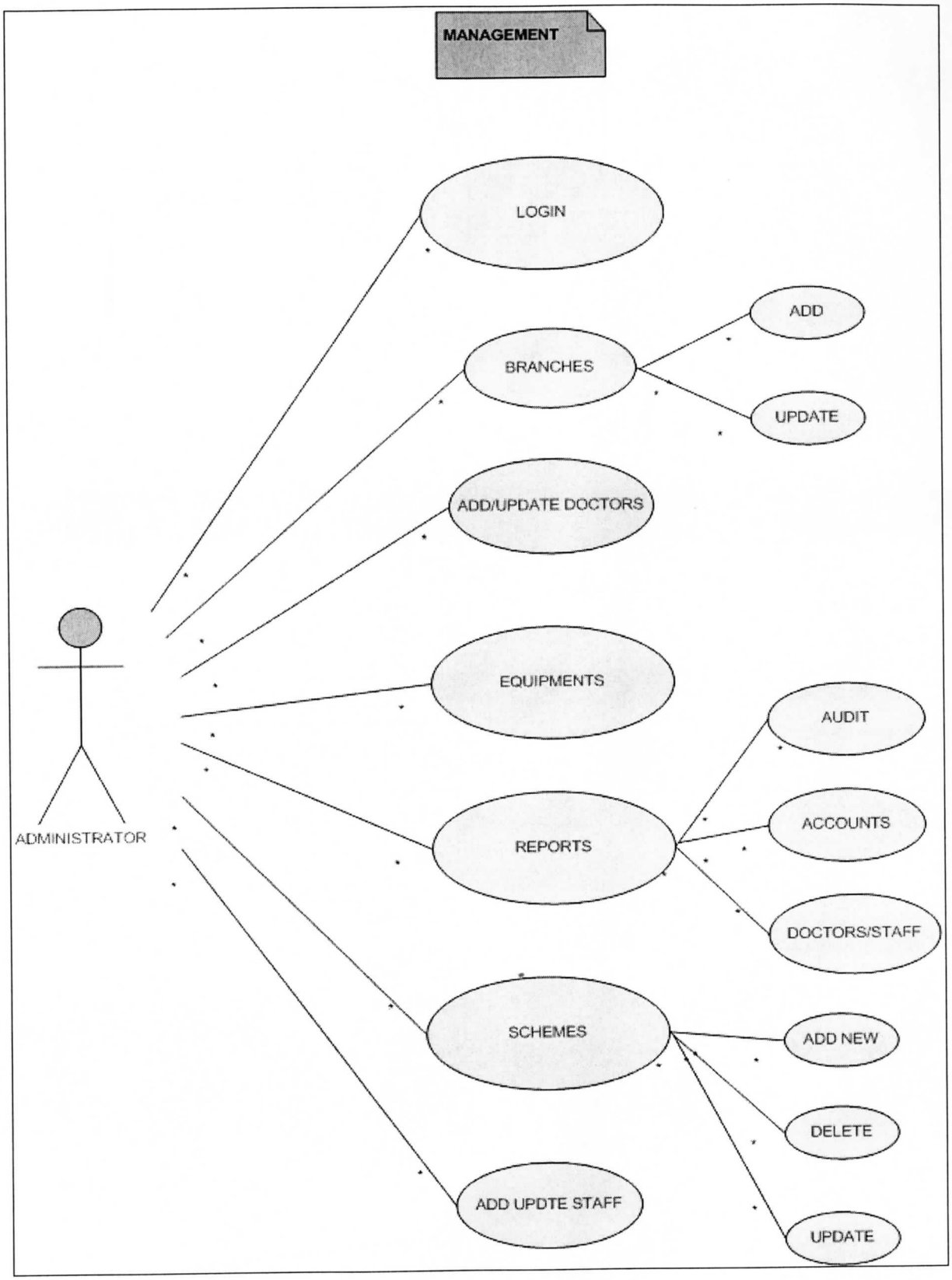

Figure 17: Use case diagram for Administrator

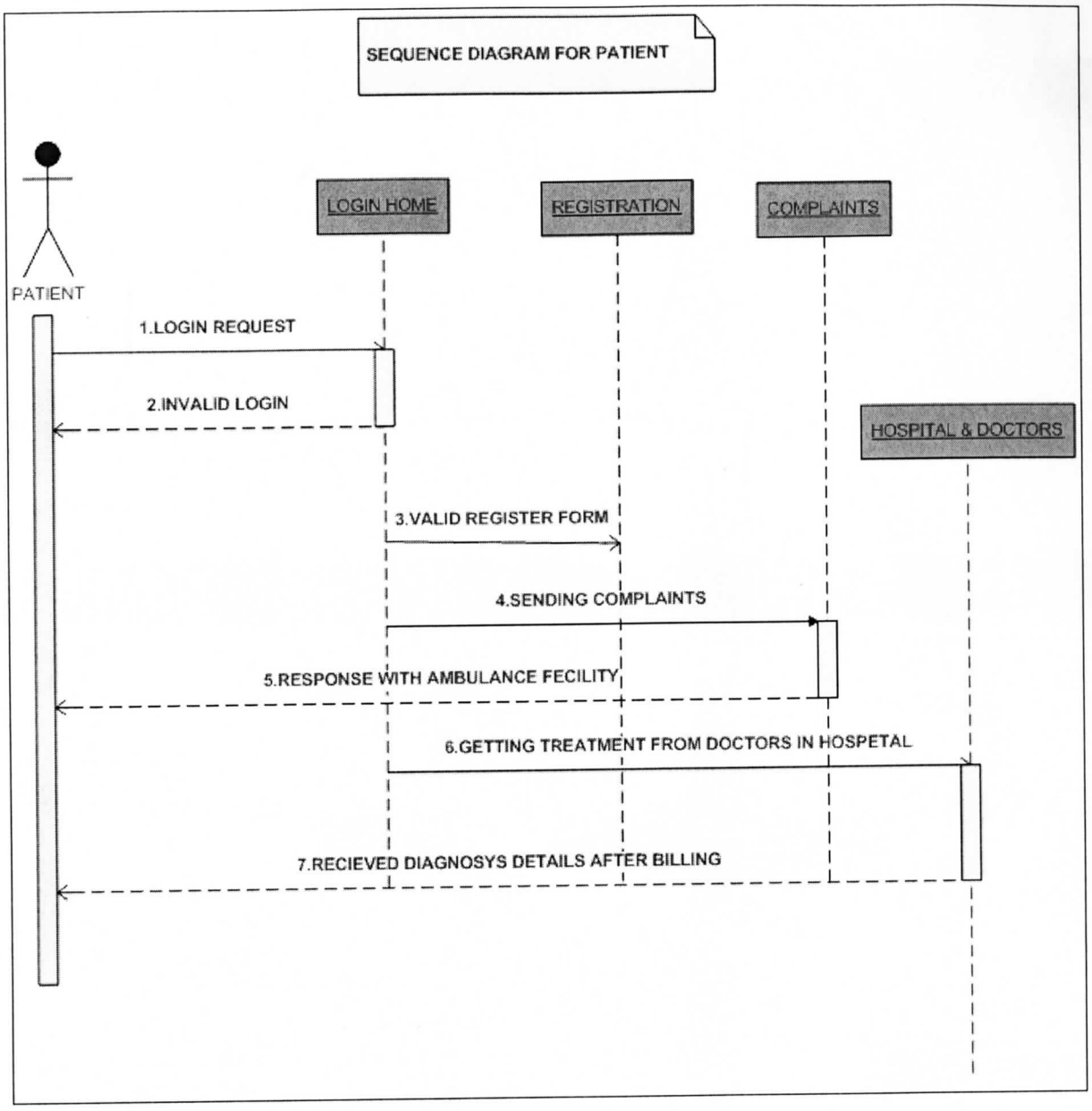

Figure 18: Sequence Diagram 1

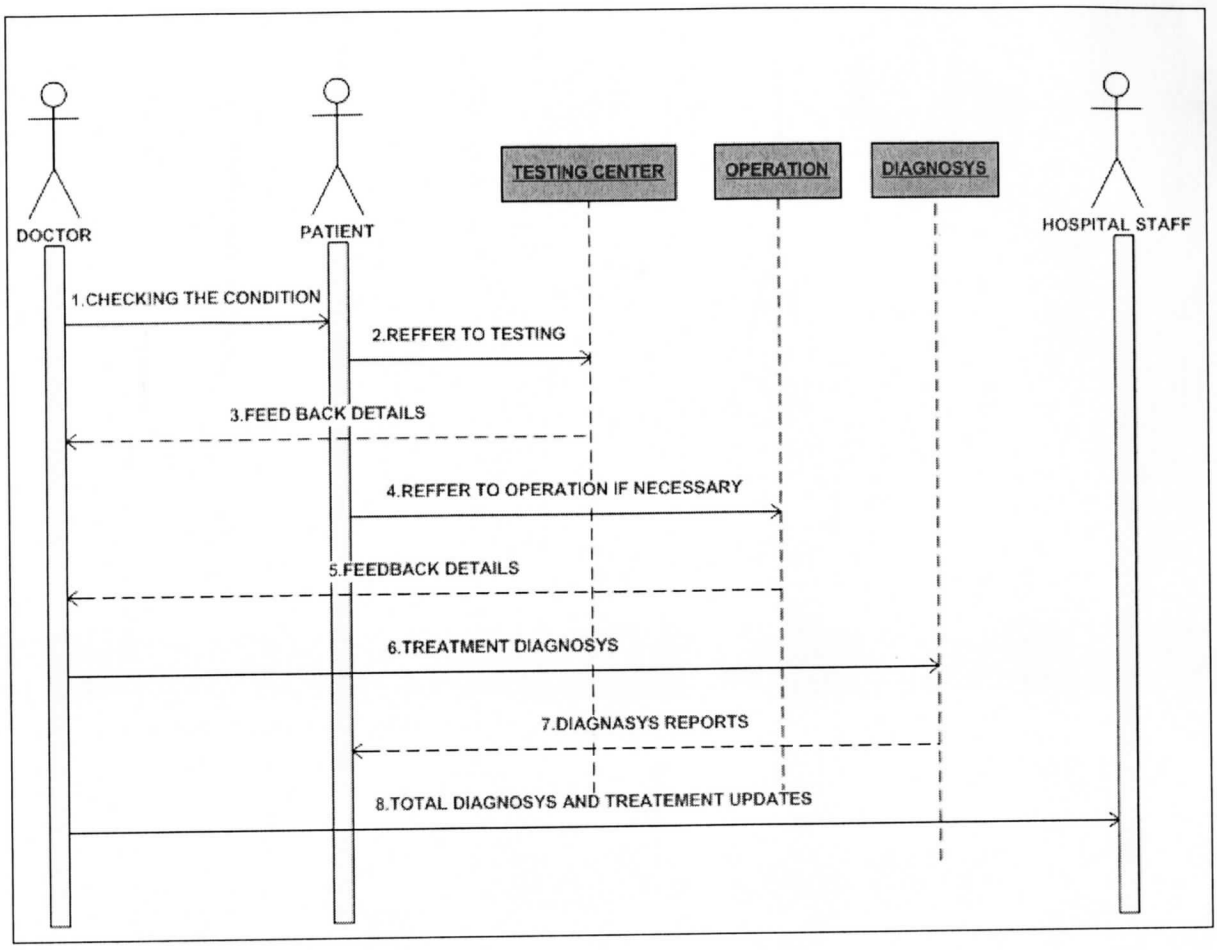

Figure 19: Sequence Diagram 2

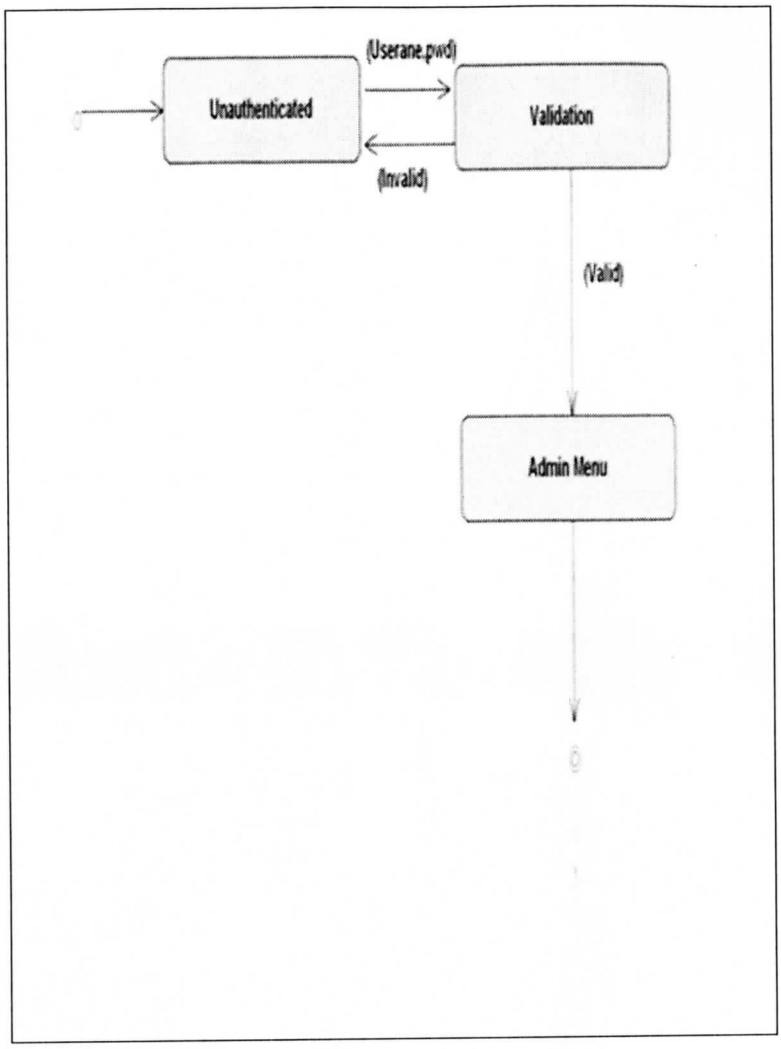

Figure 20: State Diagram

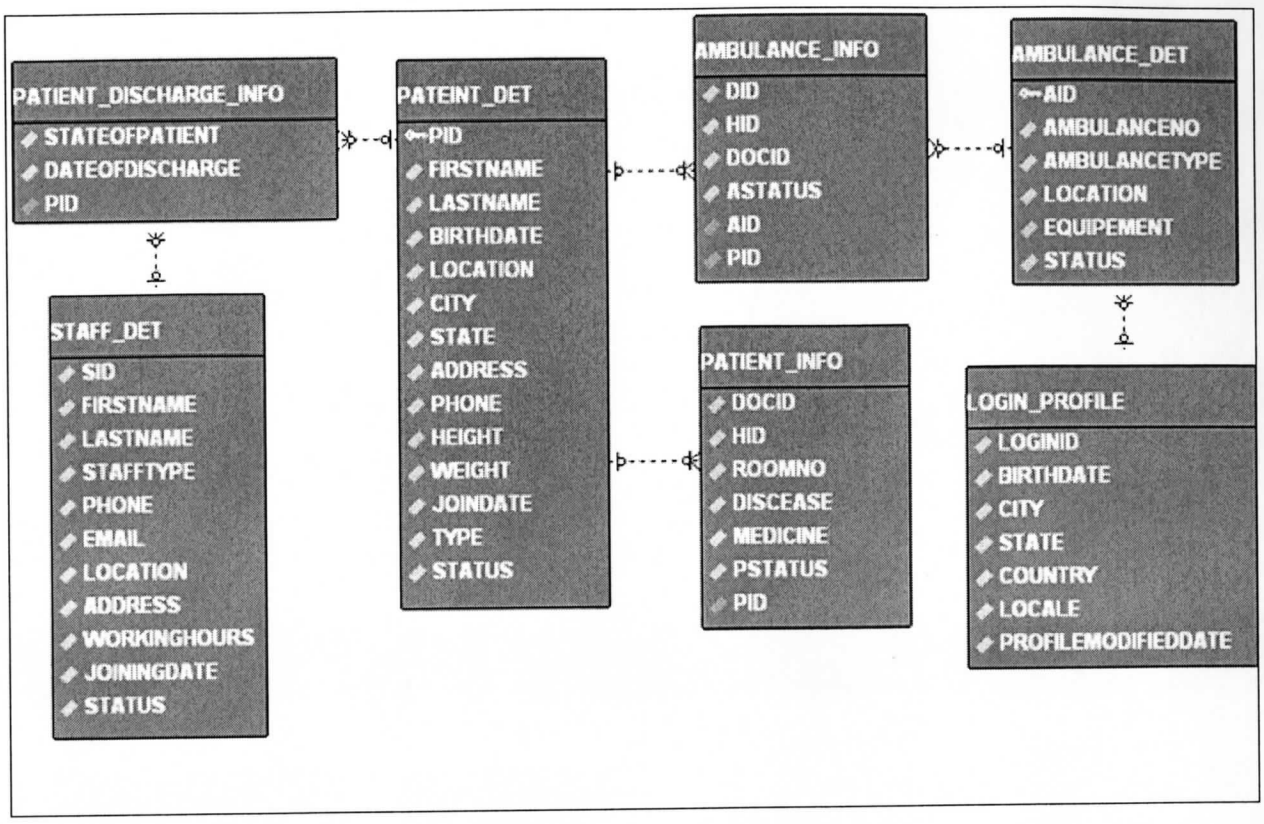

Figure 21: ER Diagram 1

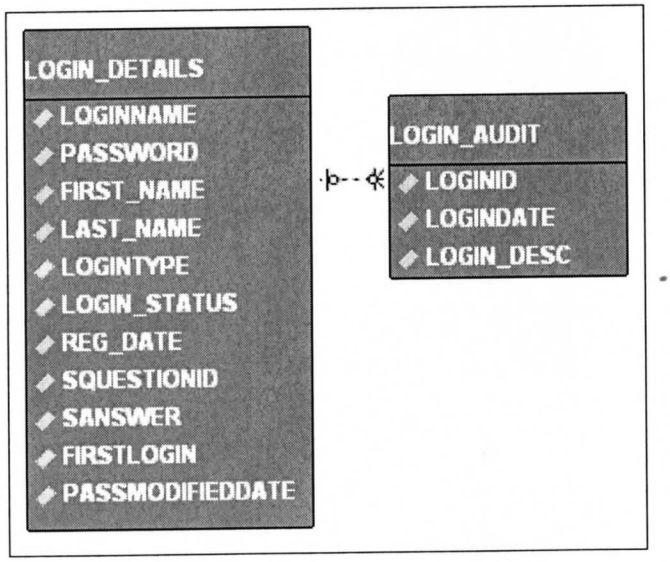

Figure 22: ER Diagram for Login

RESULTS

Figure 23: Initial Screen

Figure 24: Admin Login Page

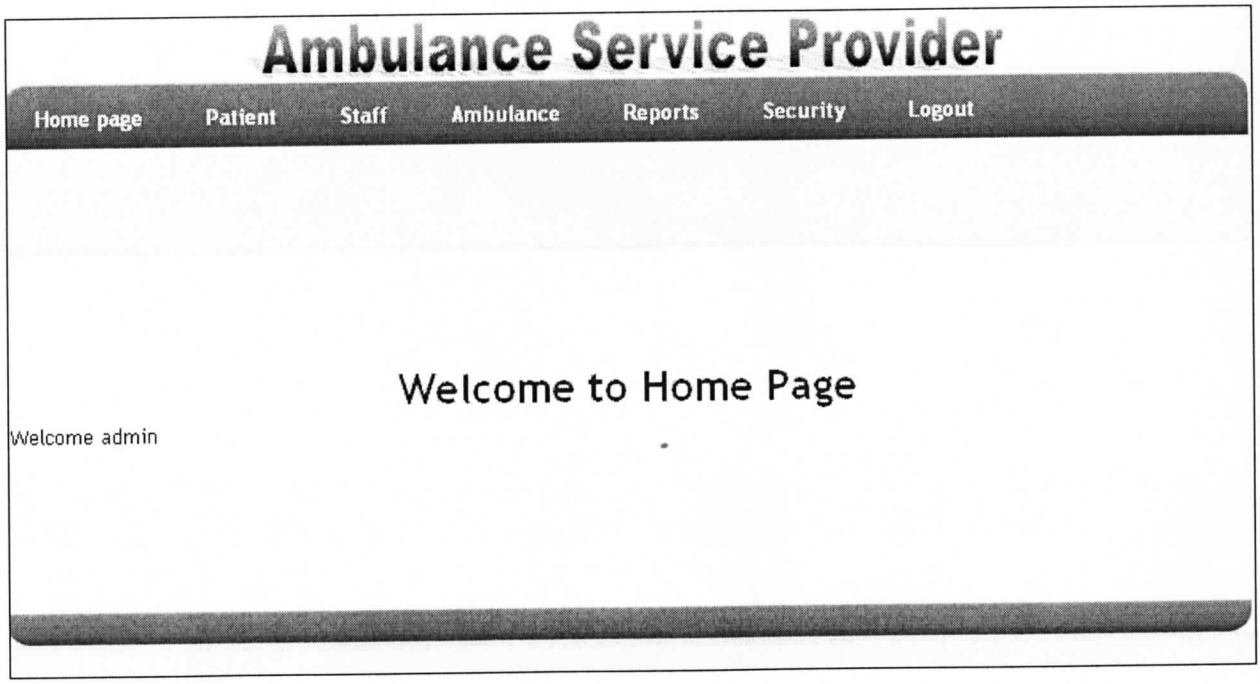

Figure 25: Admin Login Successful

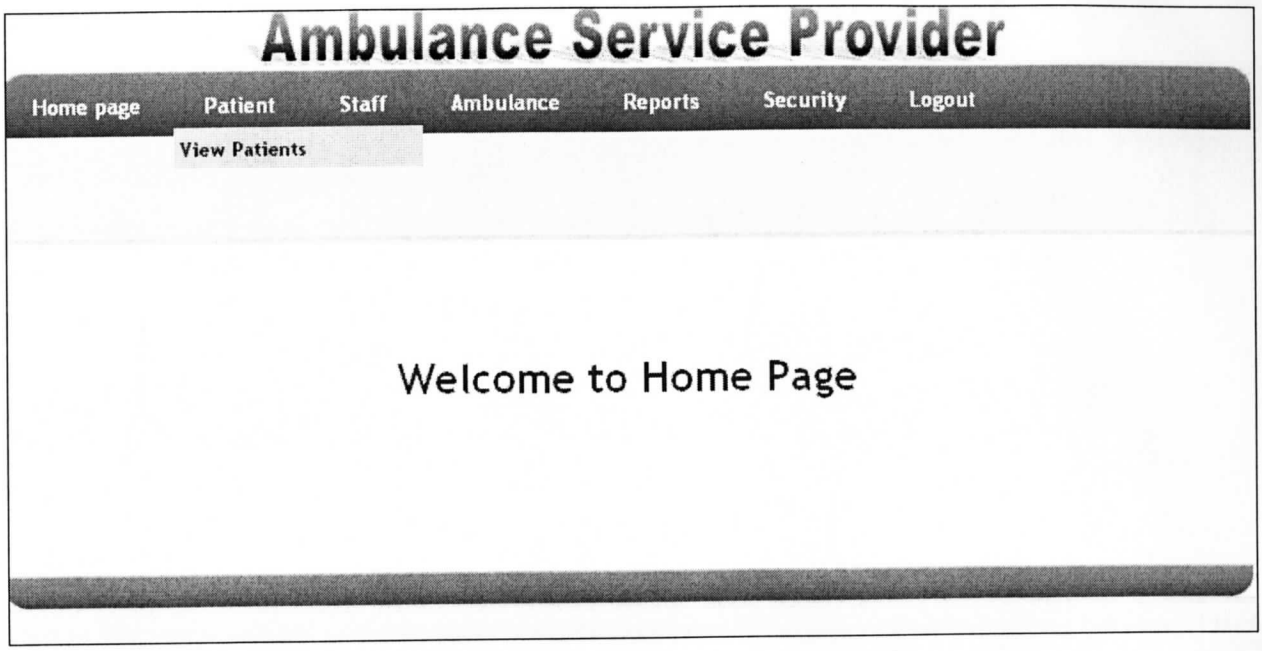

Figure 26: Patient Tab

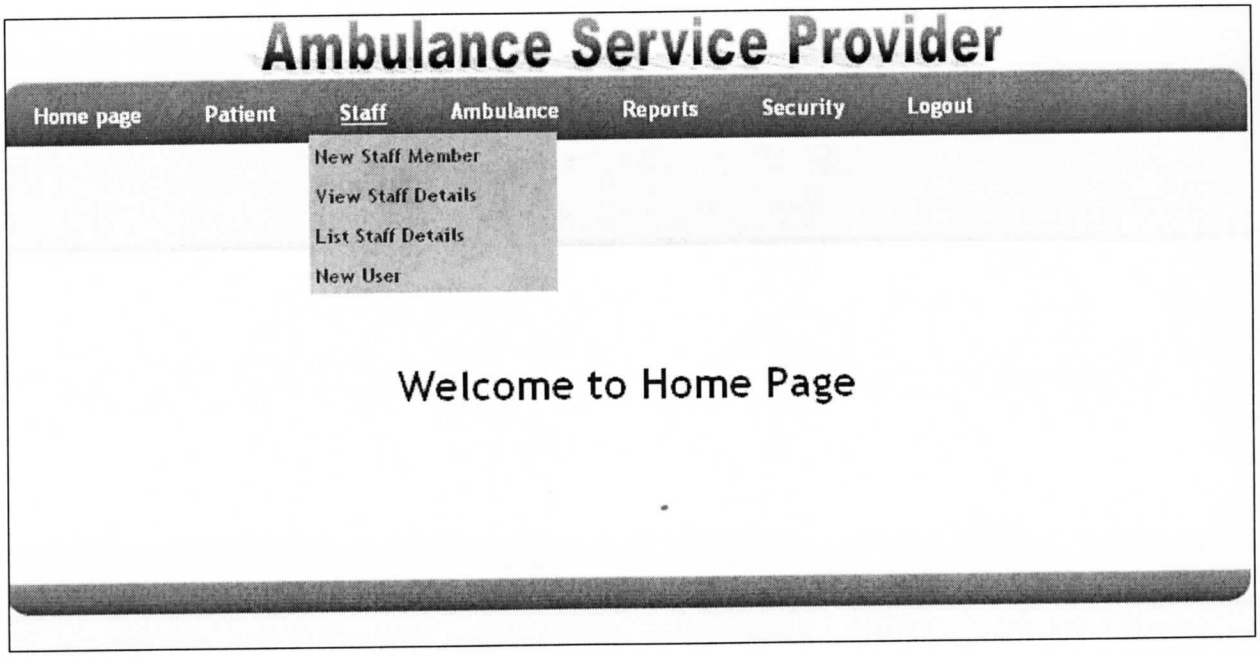

Figure 27: Staff tab

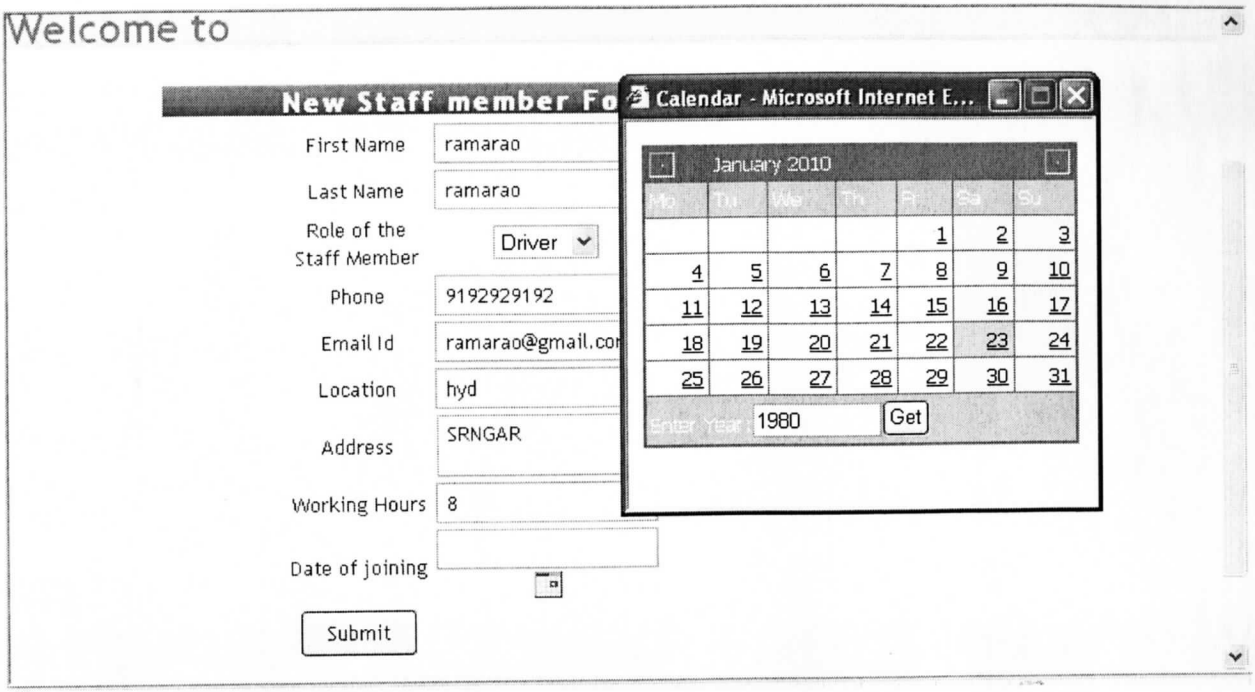

Figure 28: New Staff Member Registration

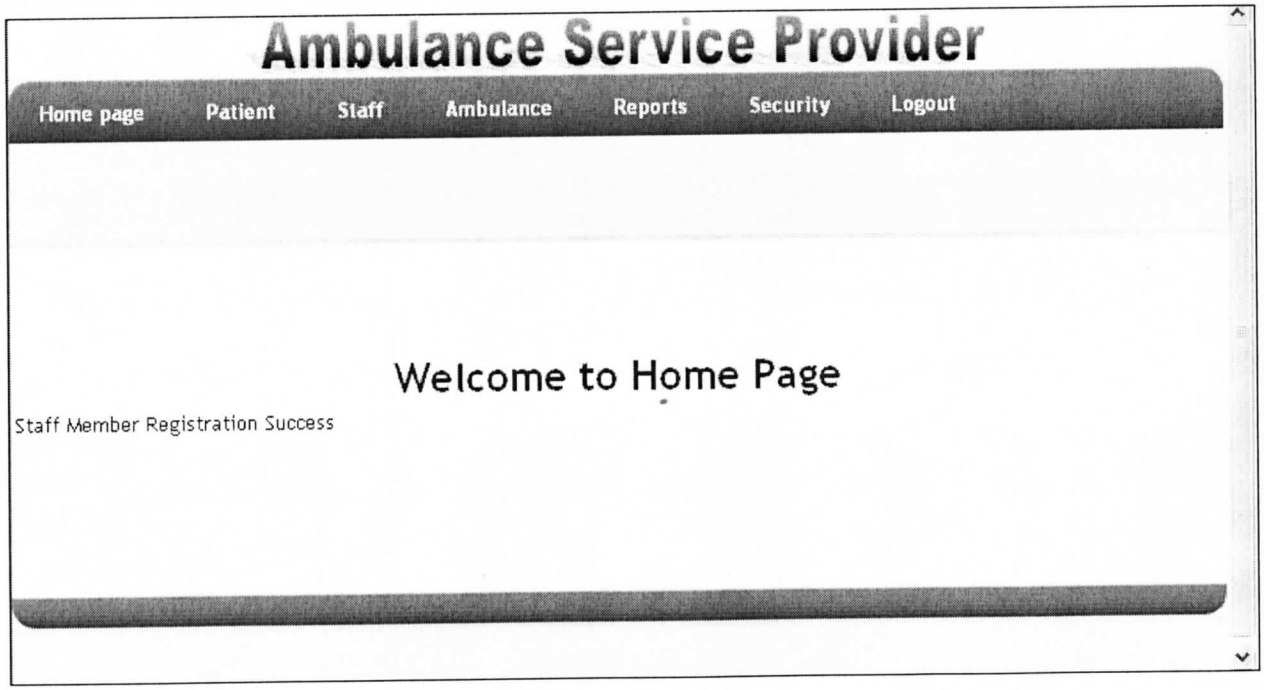

Figure 29: New Staff Member Registration Successful

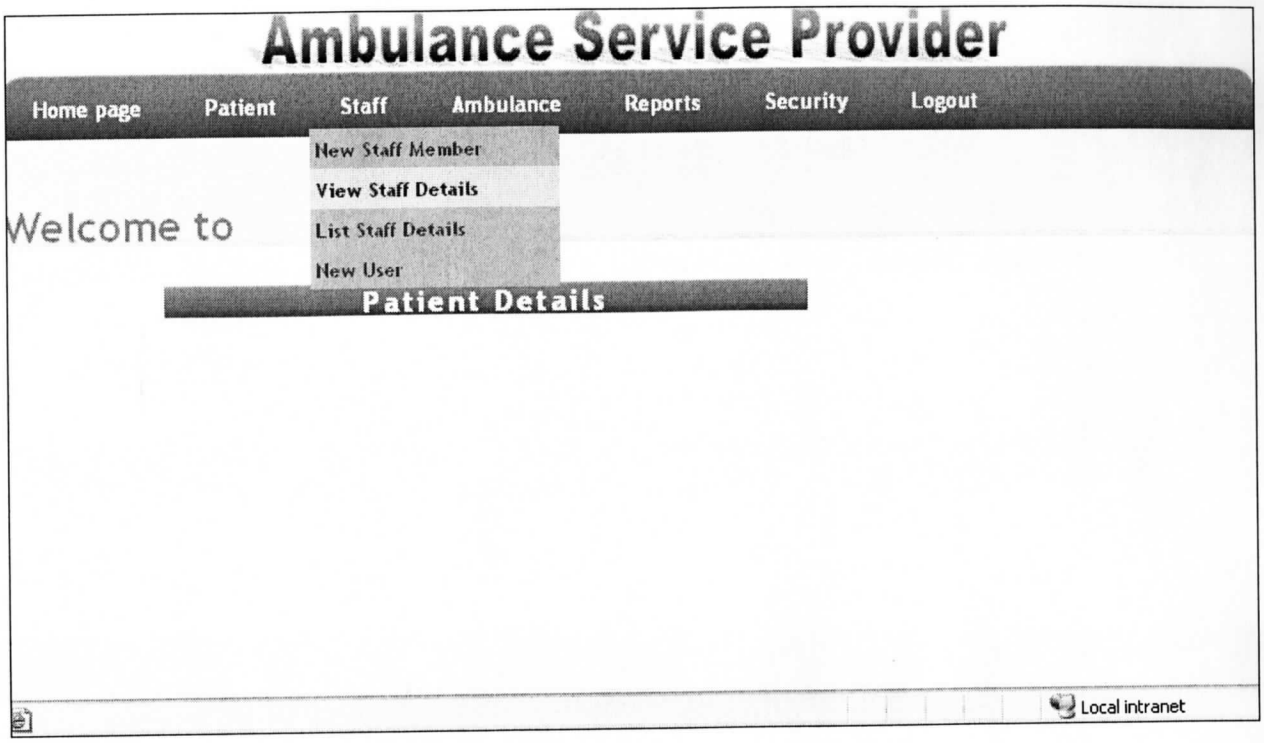

Figure 30: View Staff Member Details 1

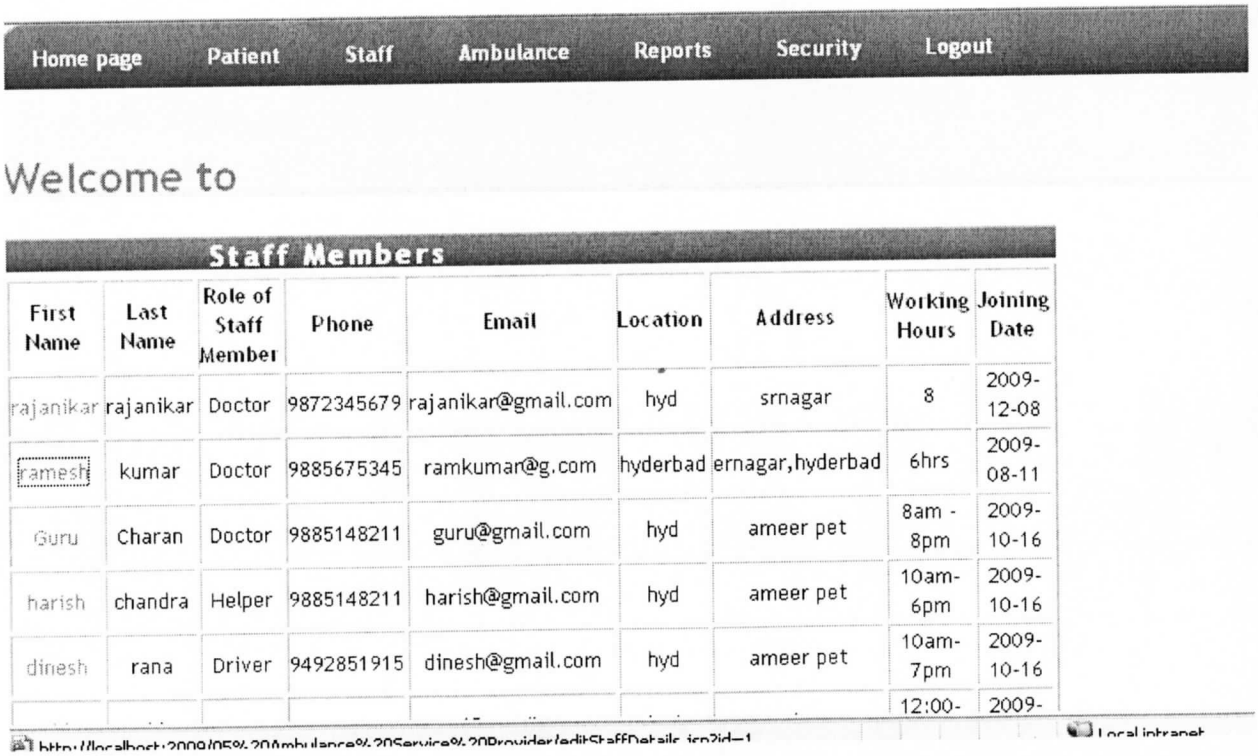

Figure 31: View Staff Member details 2

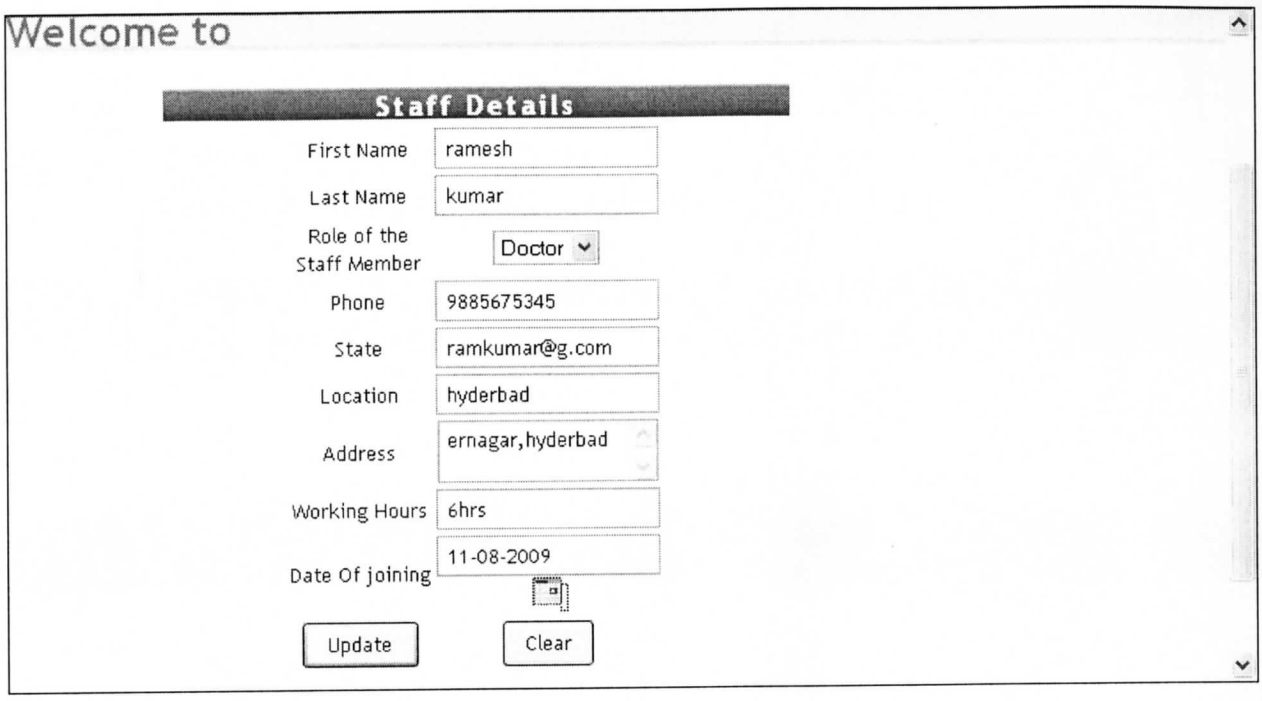

Figure 32: View Staff Member Details 3

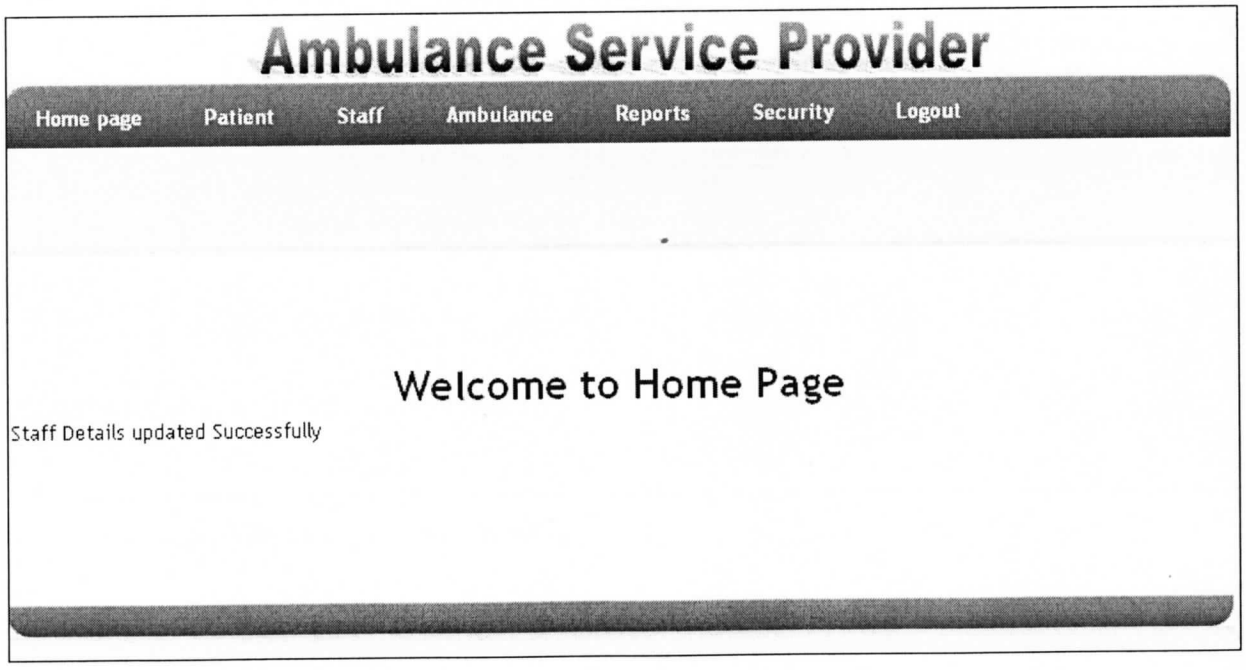

Figure 33: Update Staff Details

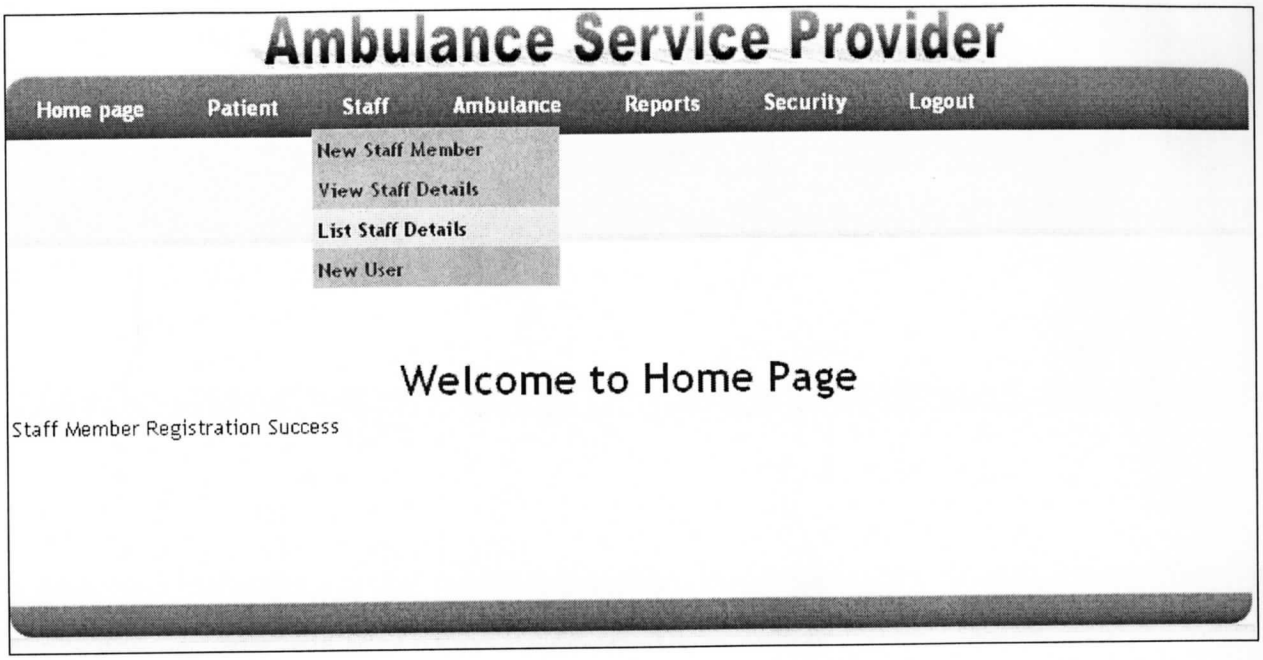

Figure 34: List Staff Details

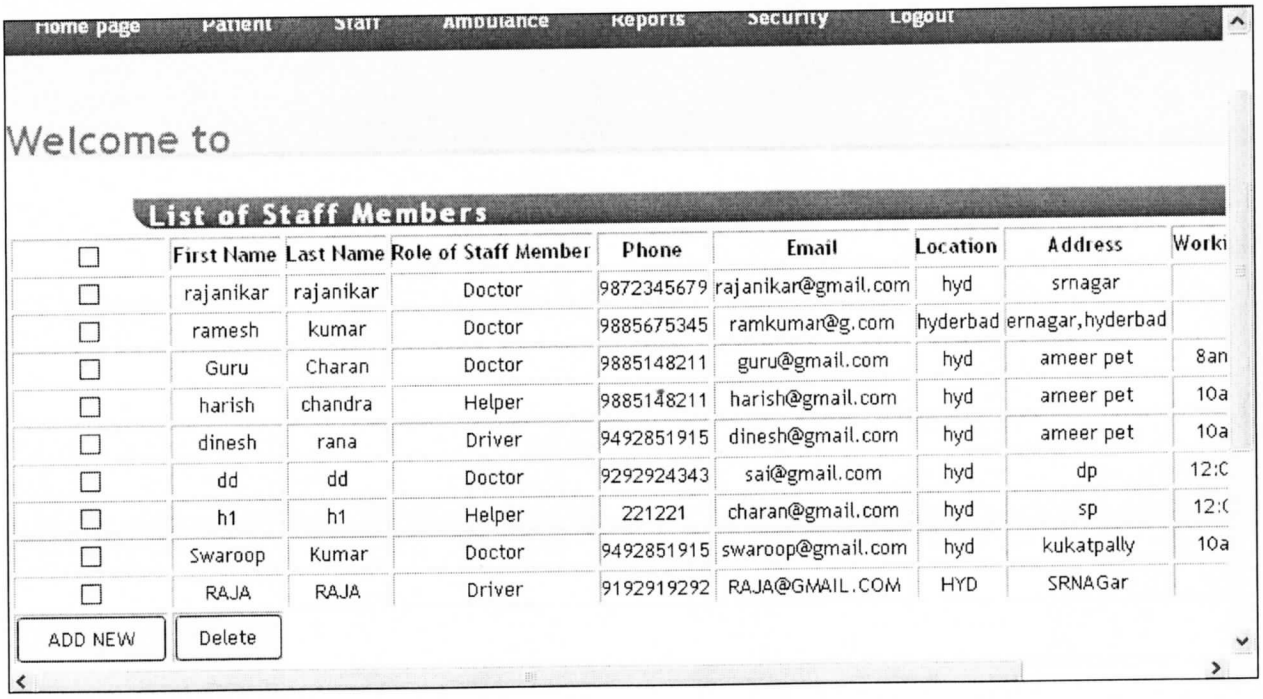

Figure 35: List of Staff Members

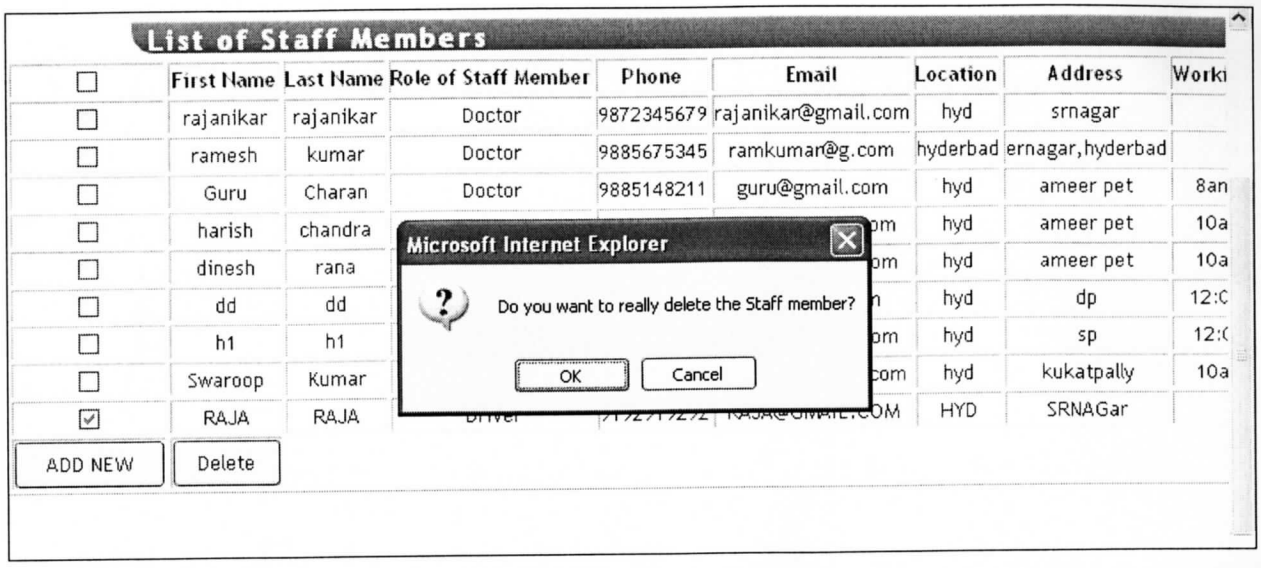

Figure 36: Deleting a Staff Member

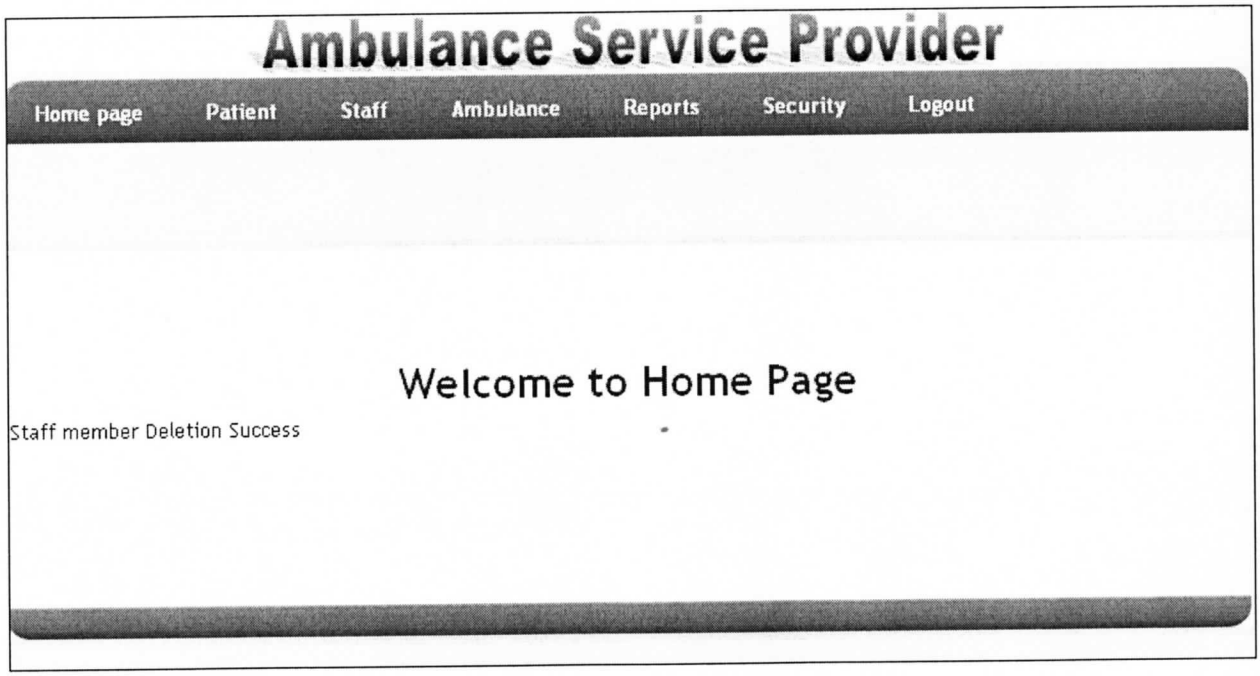

Figure 37: Staff Member Deletion Successful

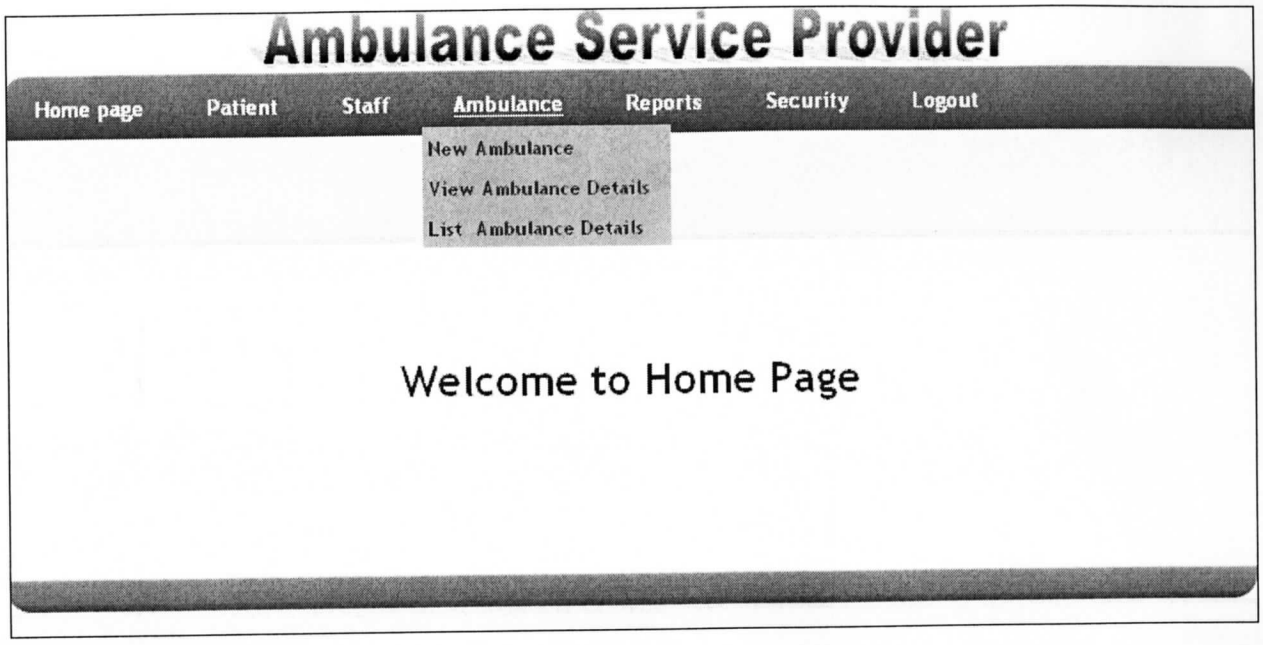

Figure 38: Ambulance Tab

Figure 39: Registering New Ambulance Form

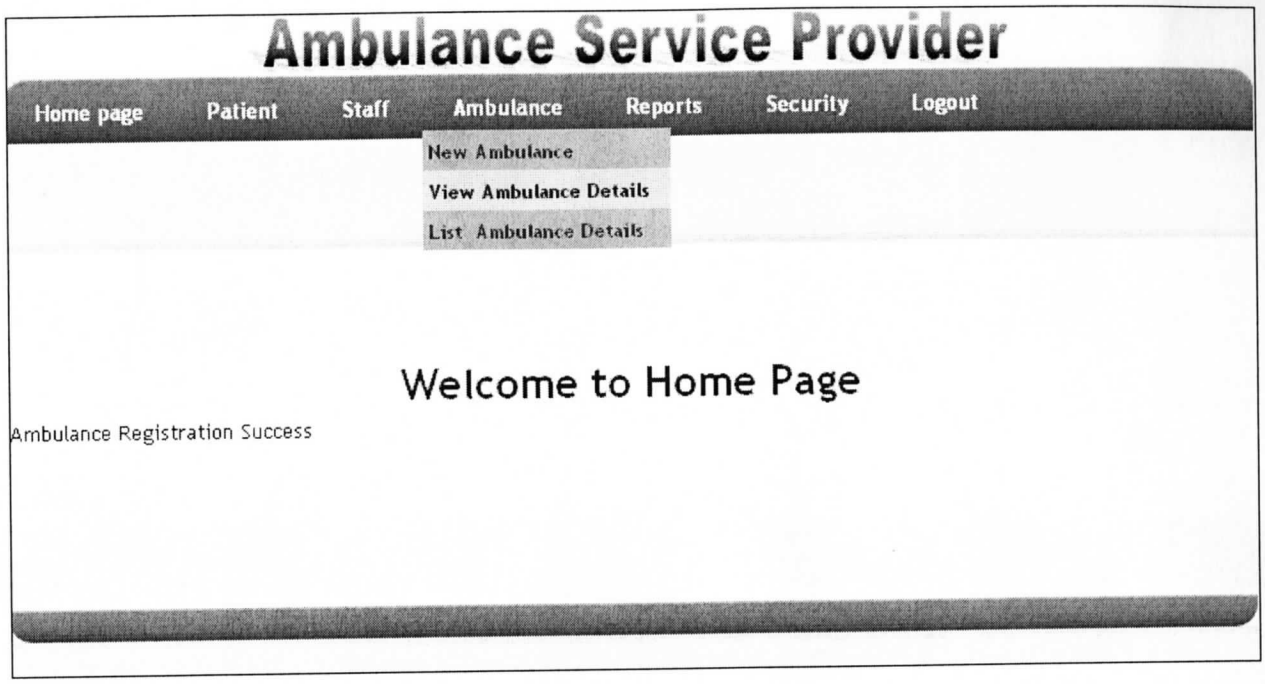

Figure 40: Ambulance Registration Successful

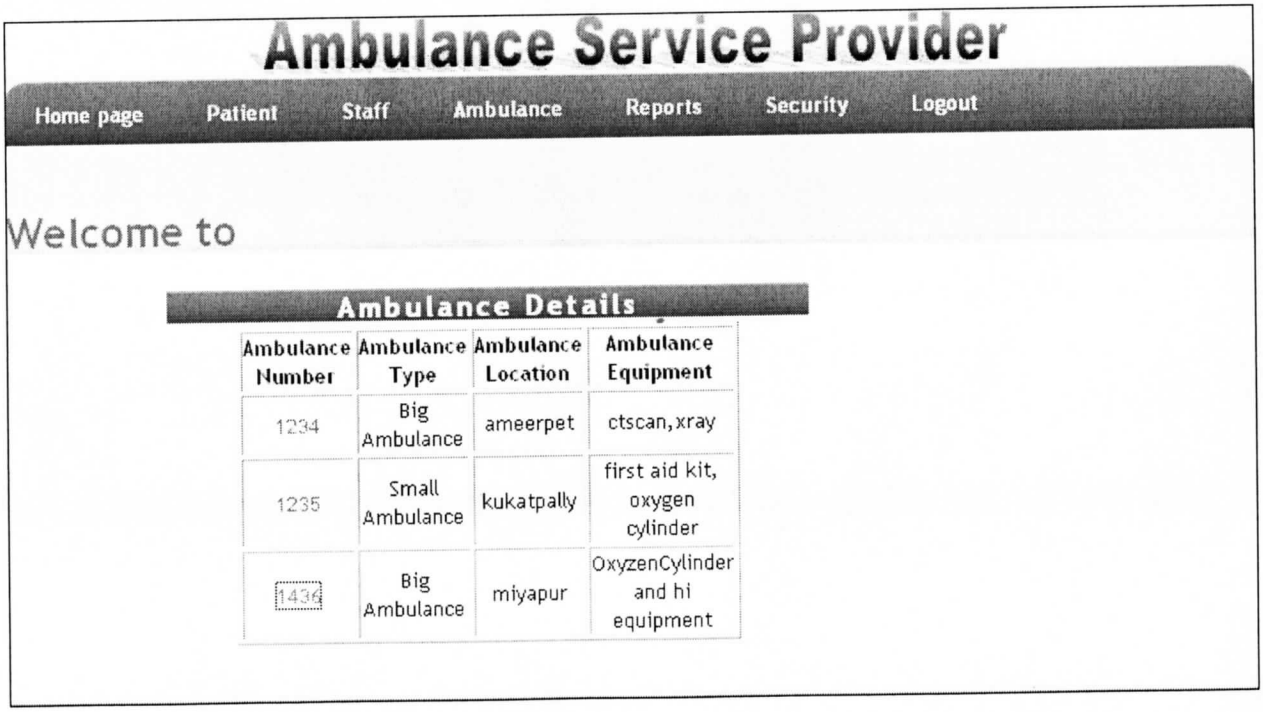

Figure 41: View/Edit Ambulance Details

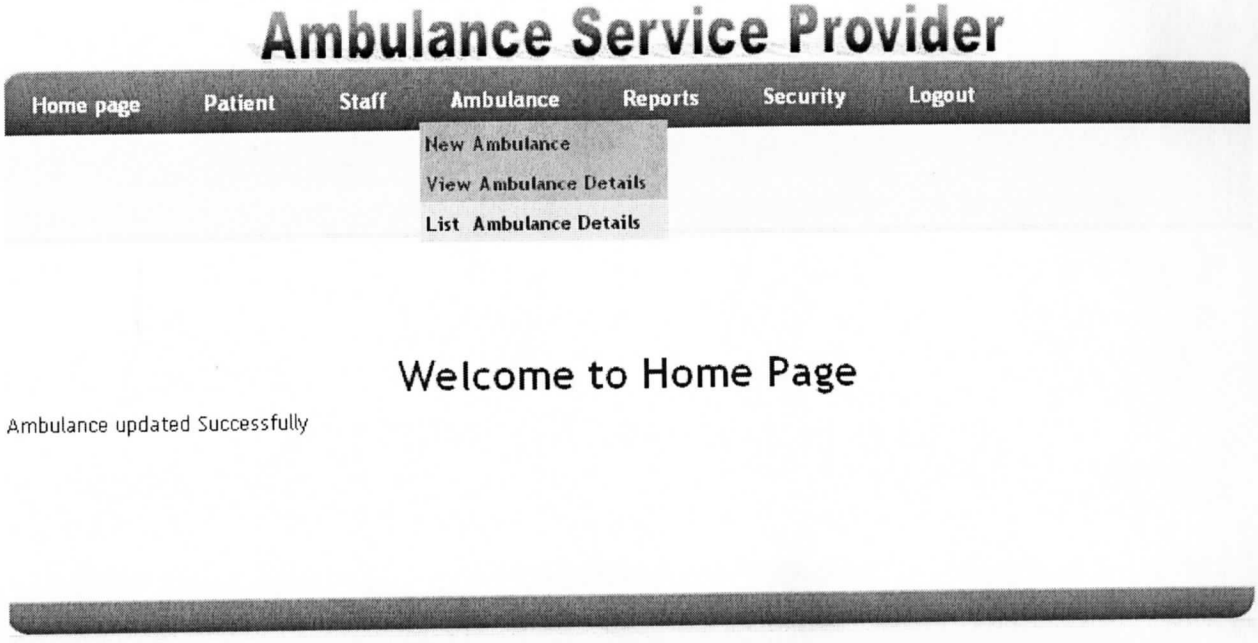

Figure 42: Ambulance Updated Successfully

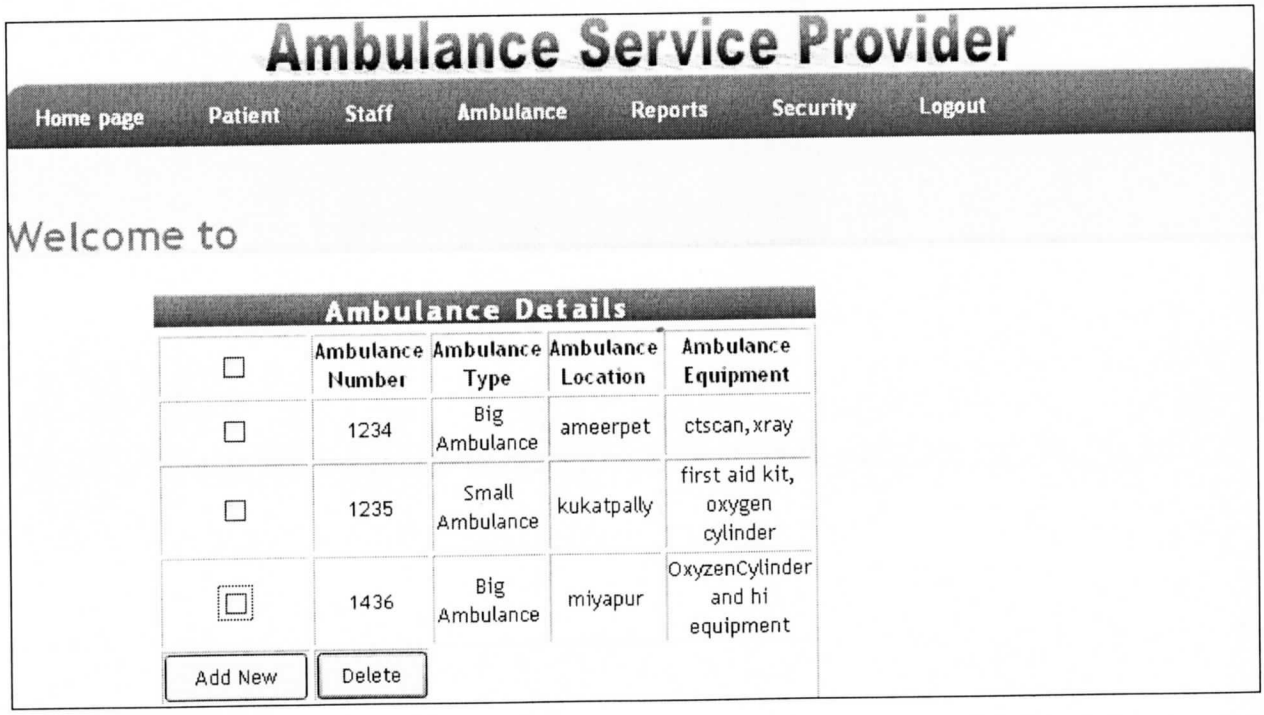

Figure 43: View Ambulance Details

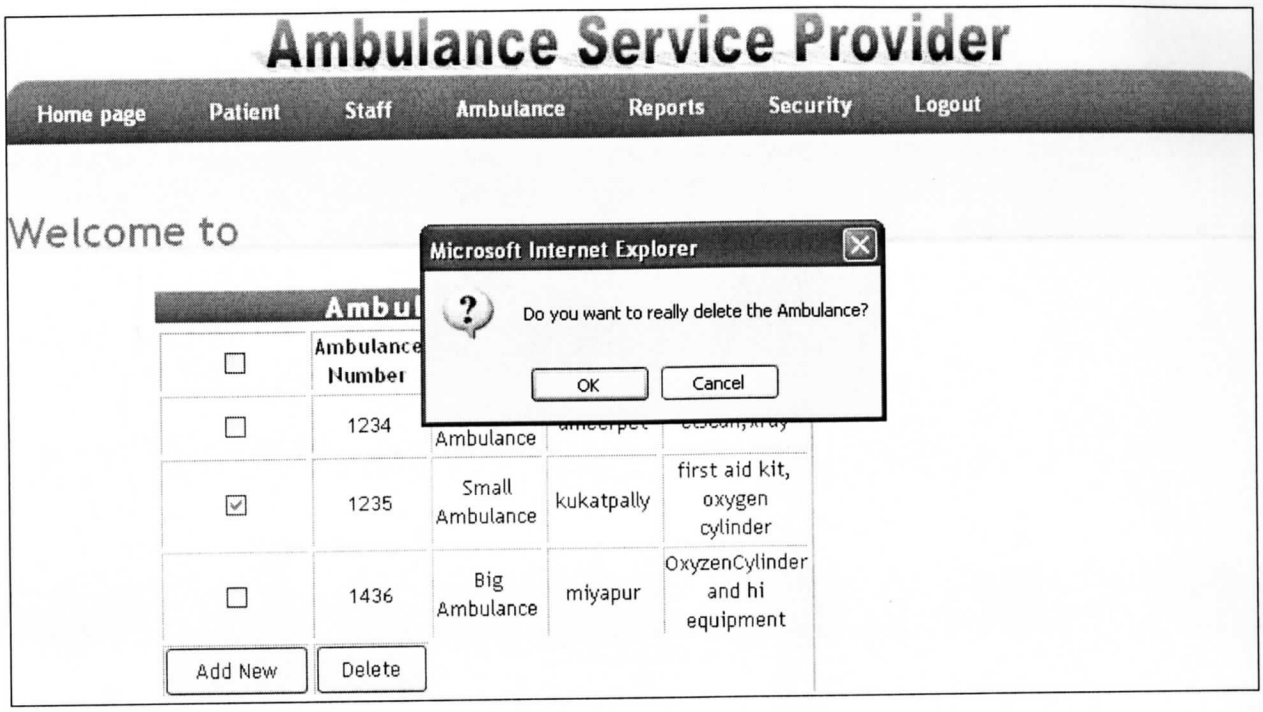

Figure 44: Delete Ambulance Details

Figure 45: Ambulance Details Deleted Successfully

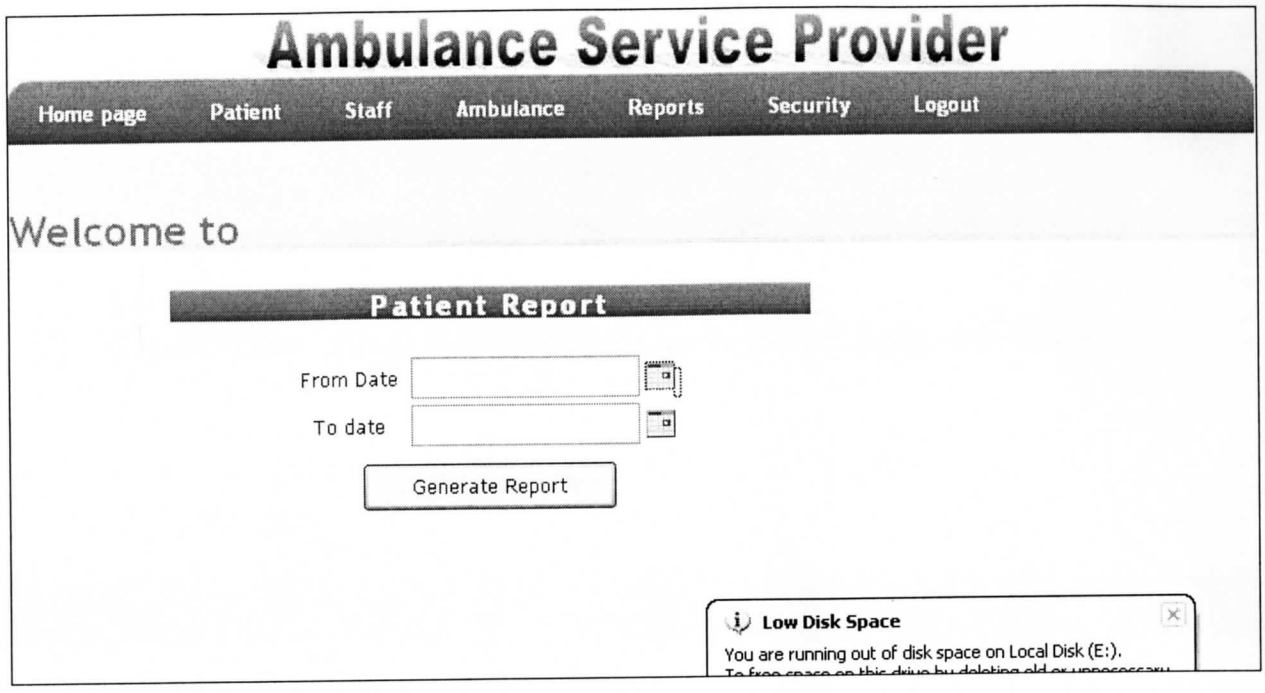

Figure 46: Generate Patient Report

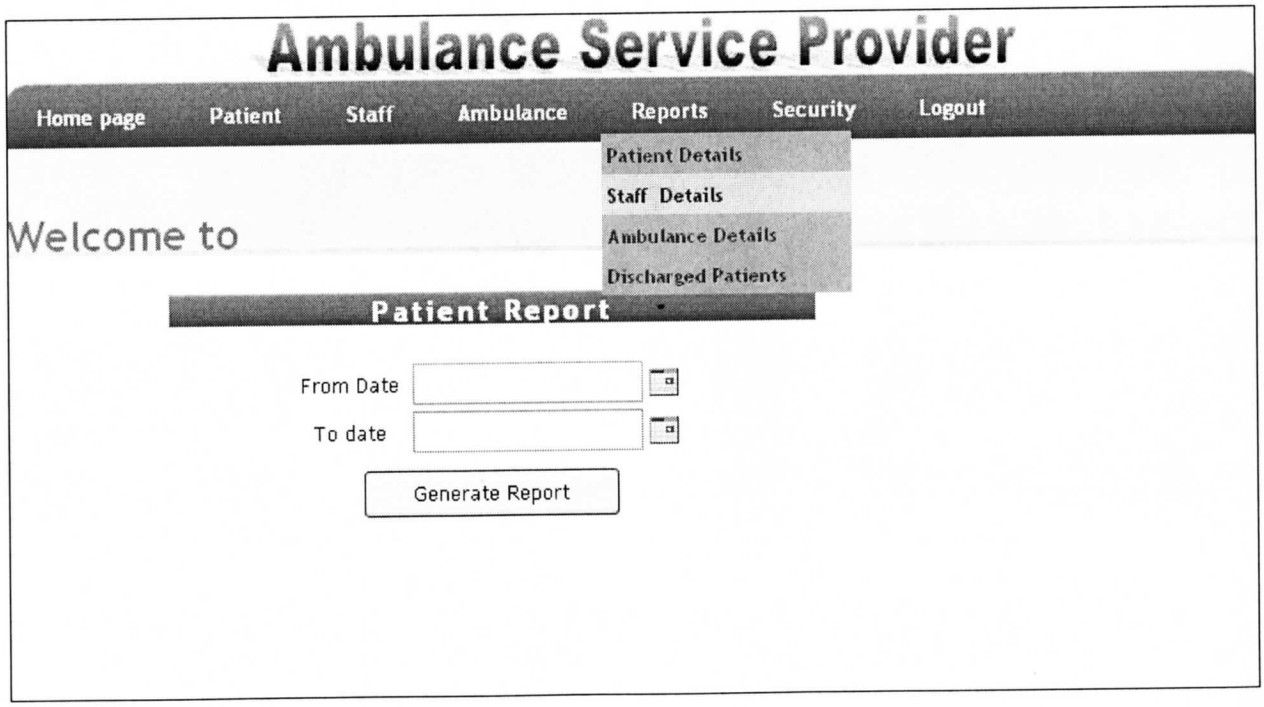

Figure 47: Staff Details

Figure 48: Generate Staff Report

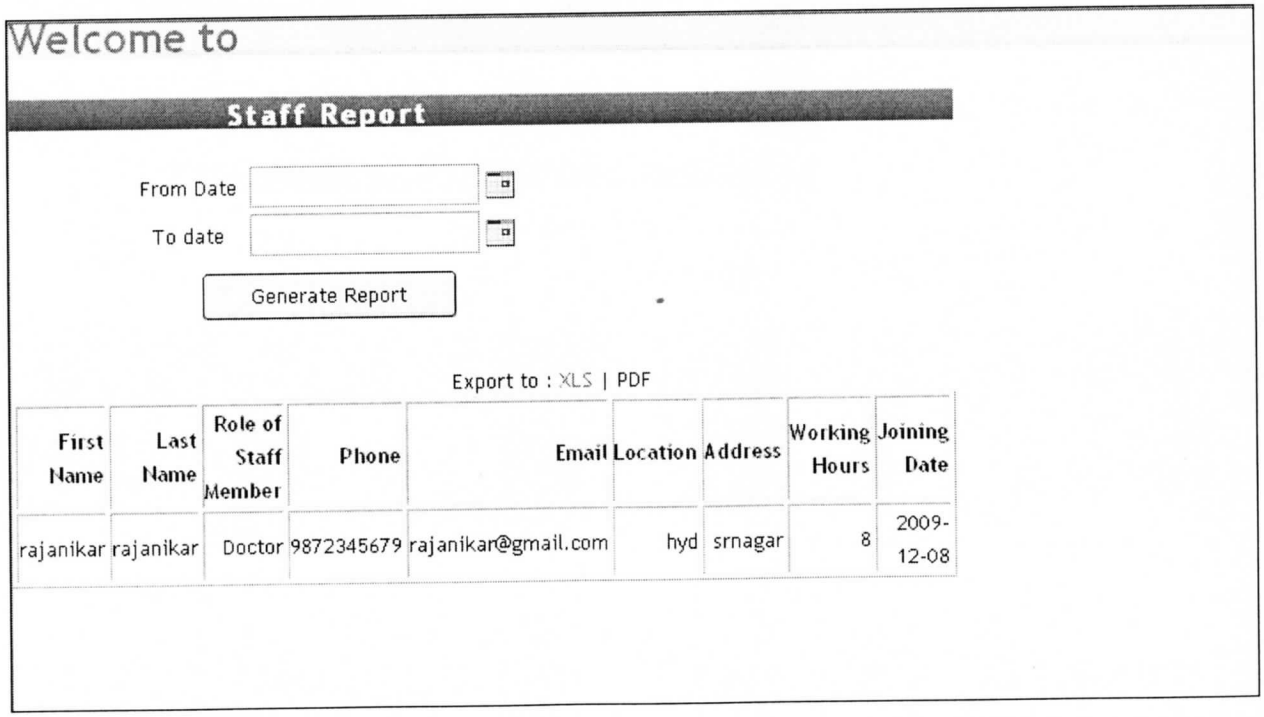

Figure 49: Generated Staff Report

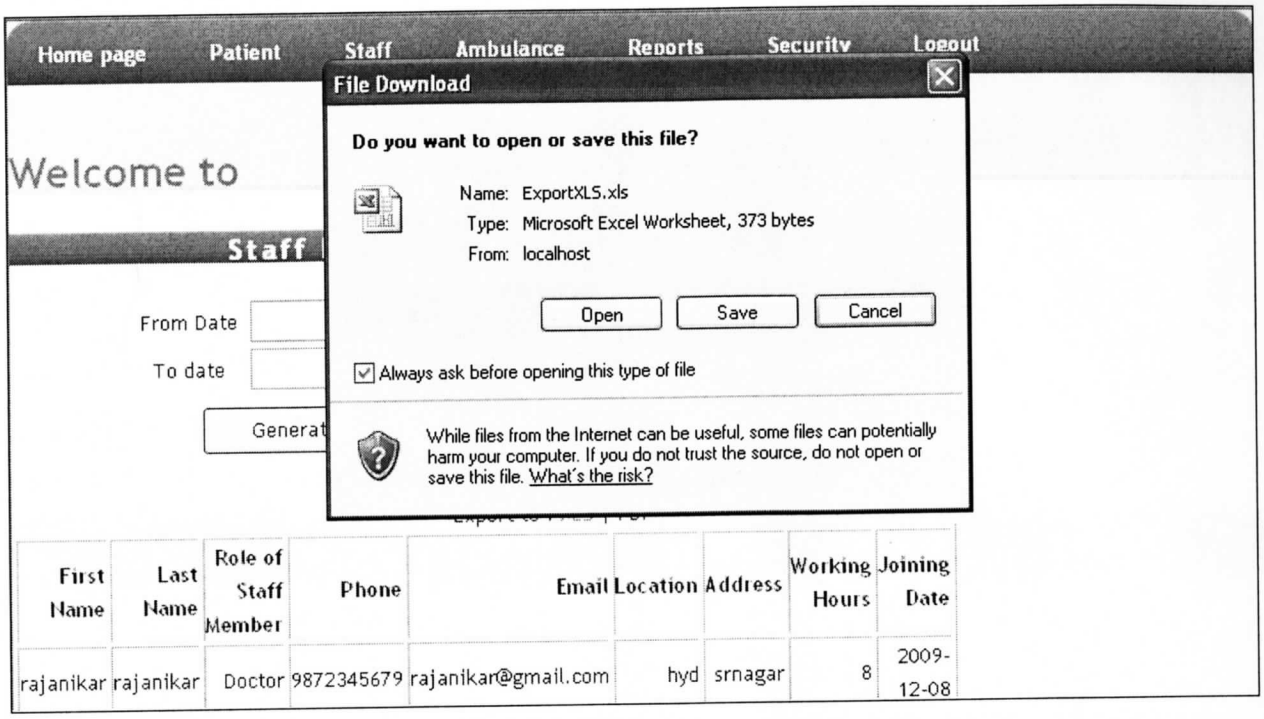

Figure 50: Export Staff Details Report

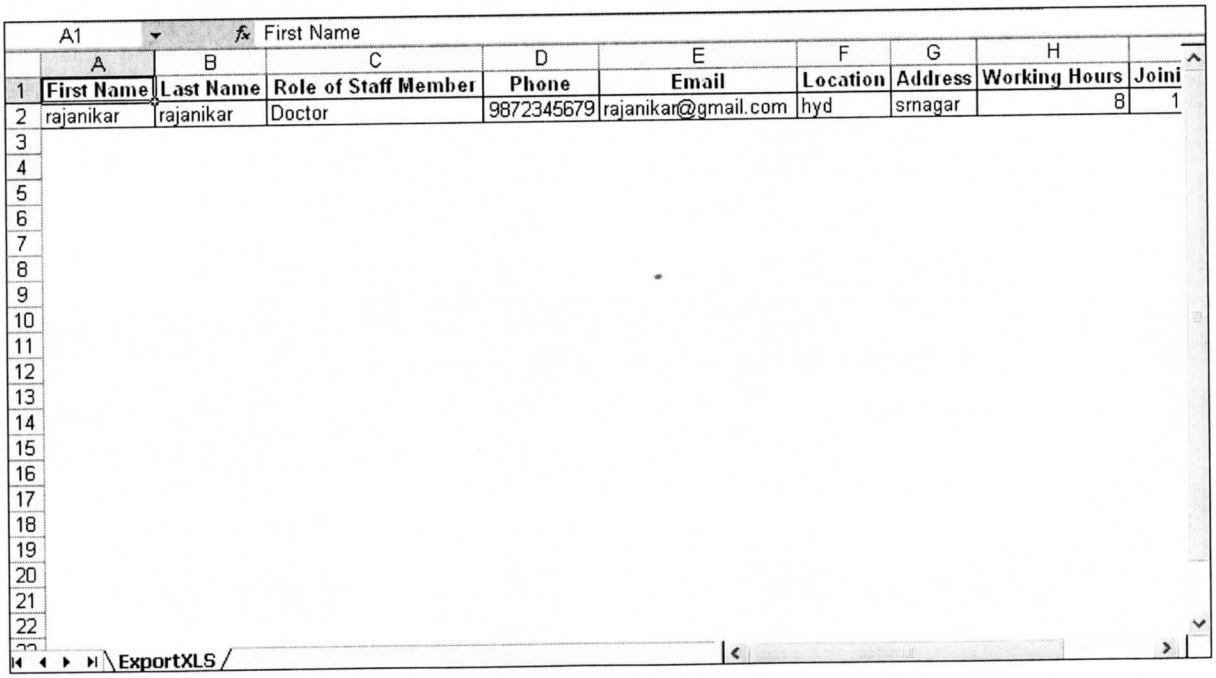

Figure 51: Exported Excel Sheet with Staff Details

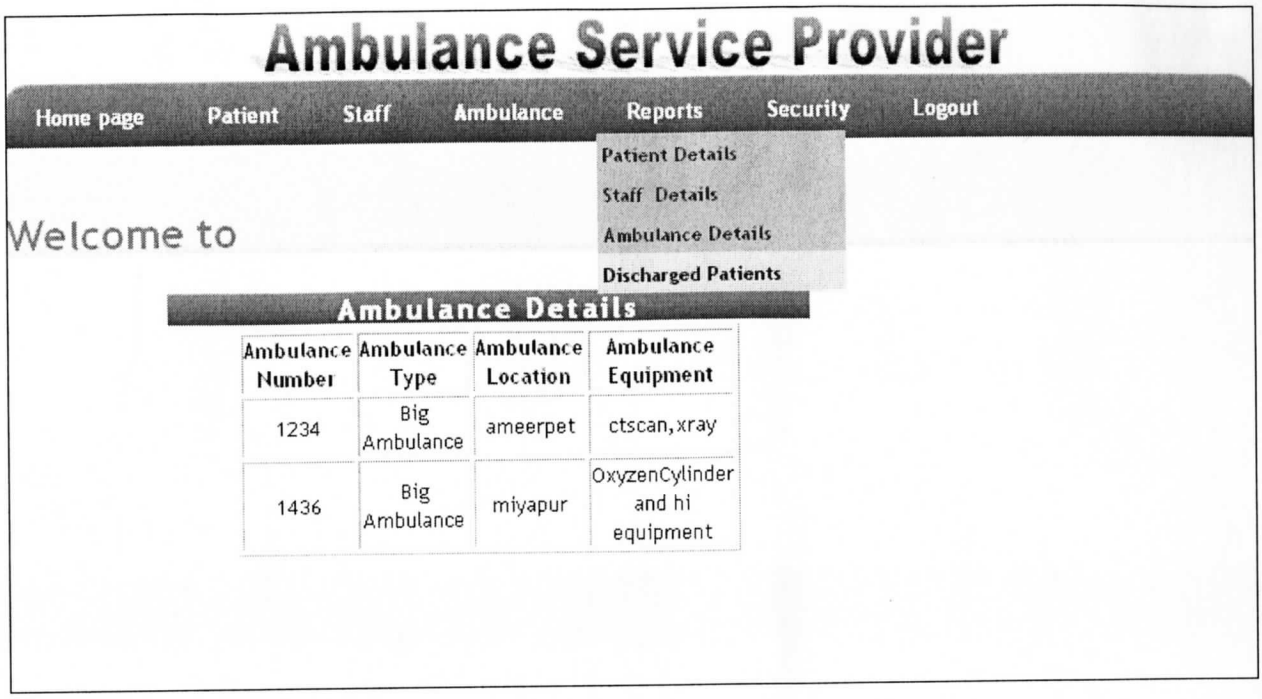

Figure 52: Ambulance Details

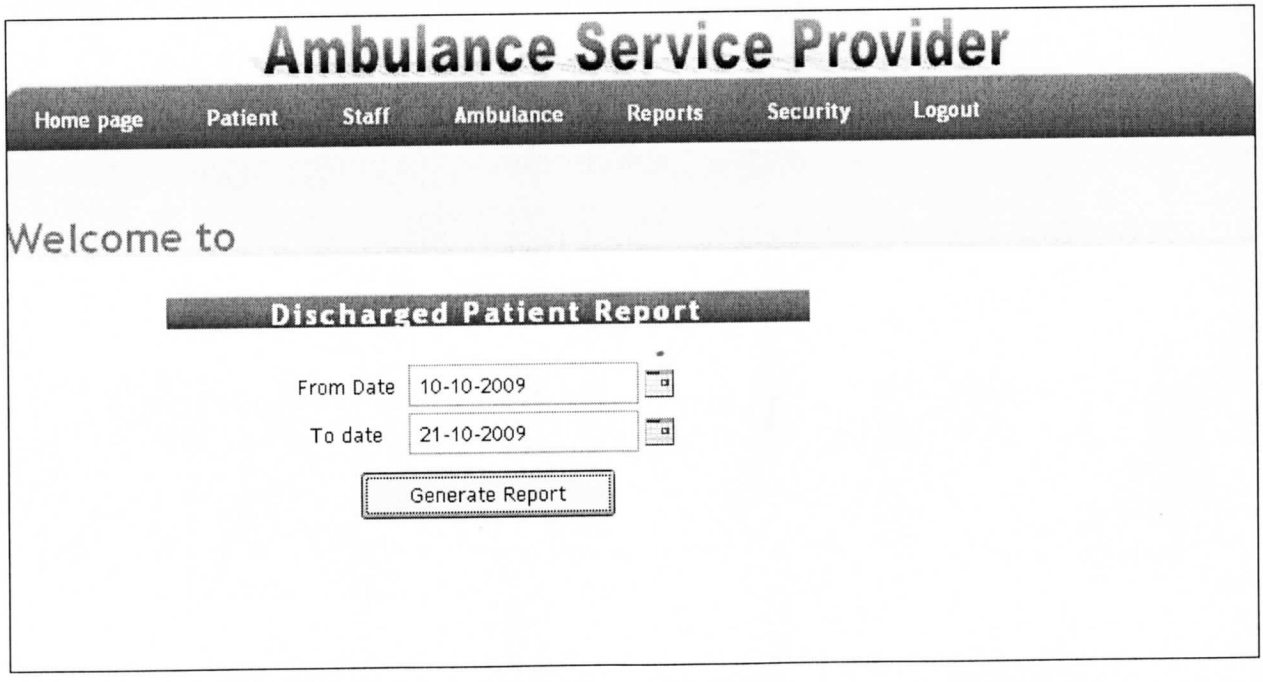

Figure 53: Generate Discharged Patient Report

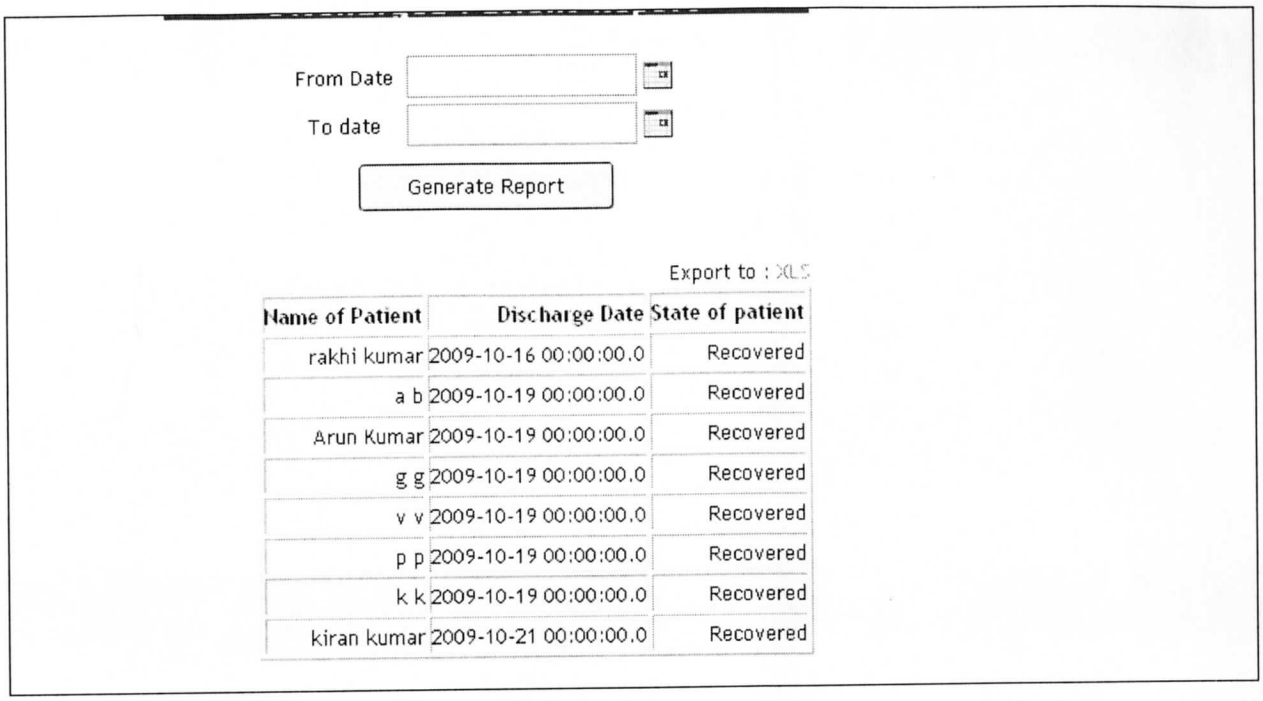

Figure 54: Generated Discharged Patient Report Details

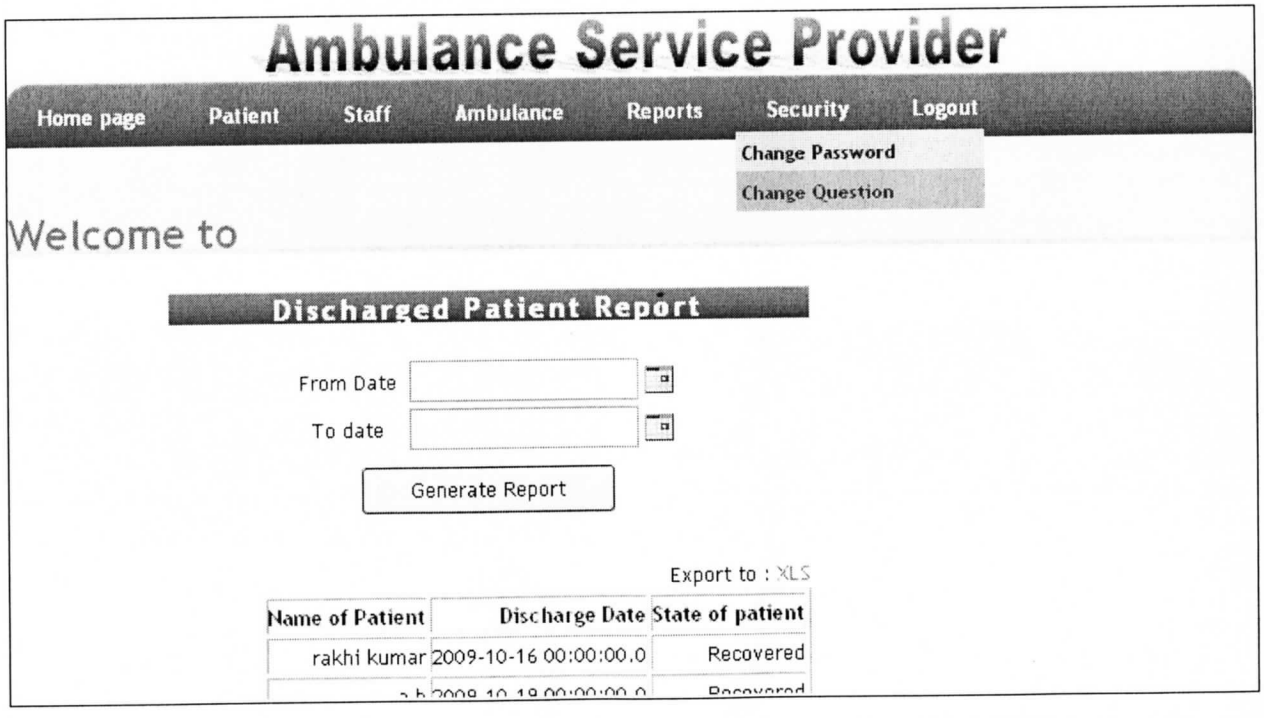

Figure 55: Security Tab

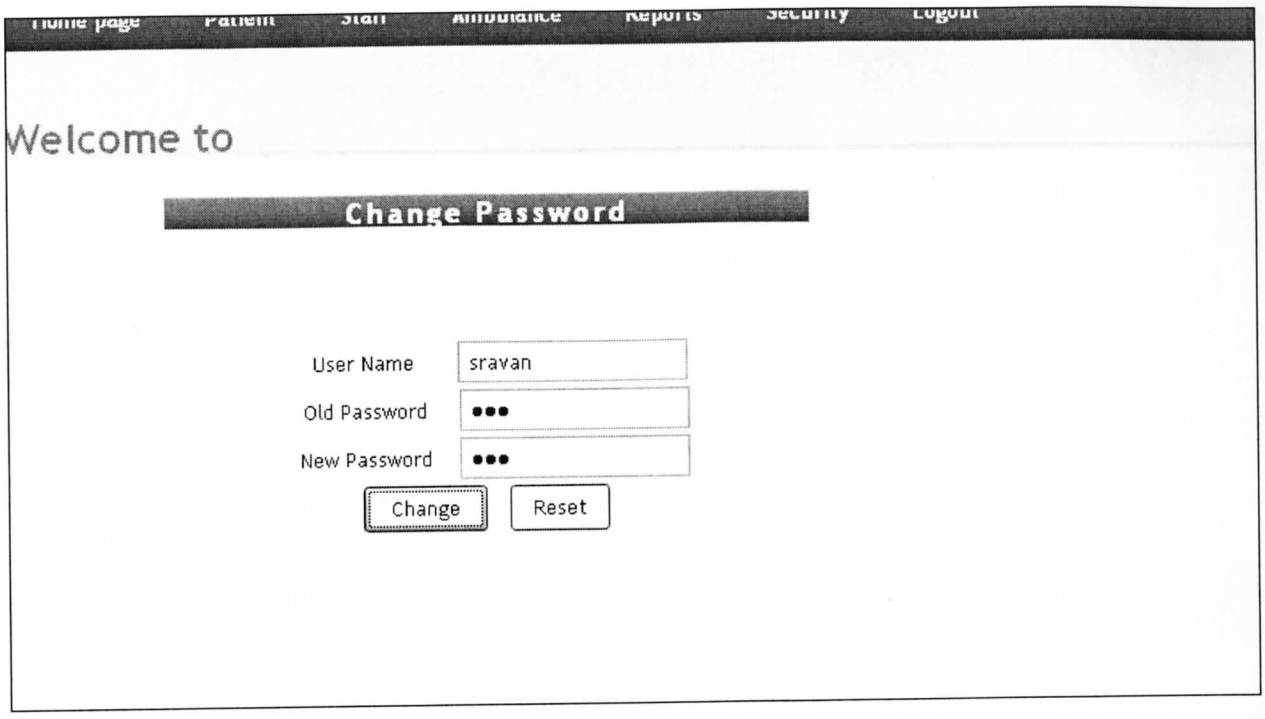

Figure 56: Change Password

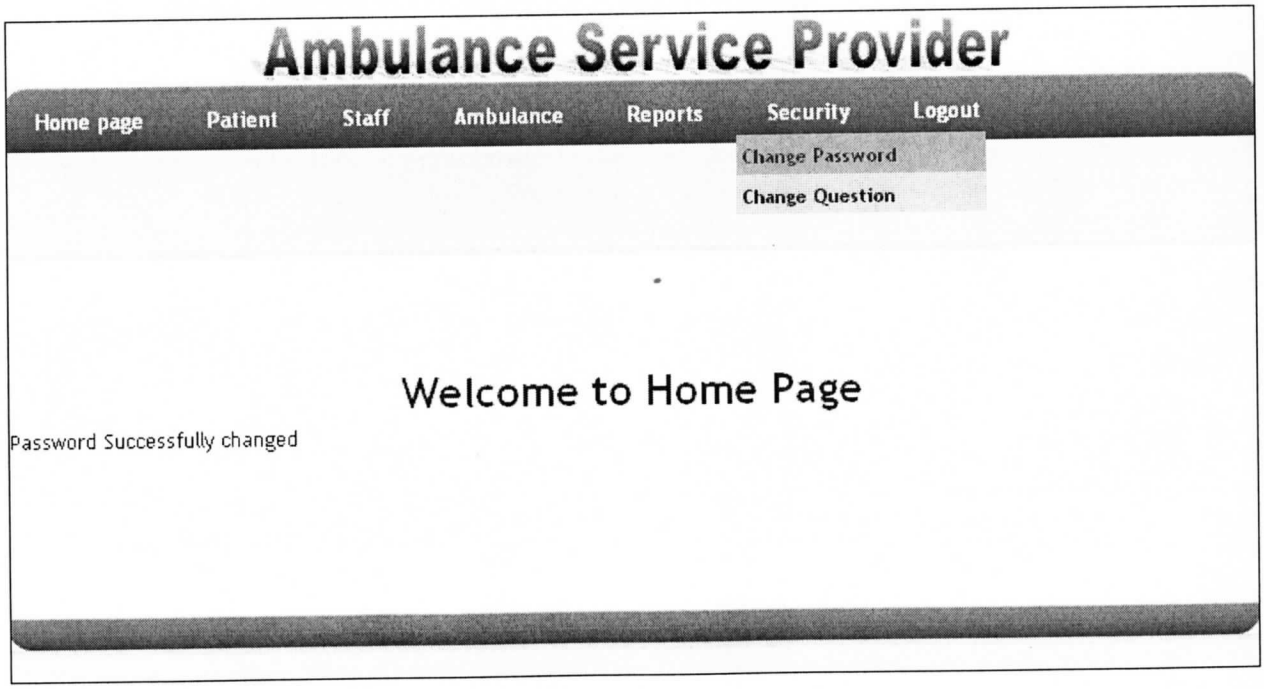

Figure 57: Password Change Successful

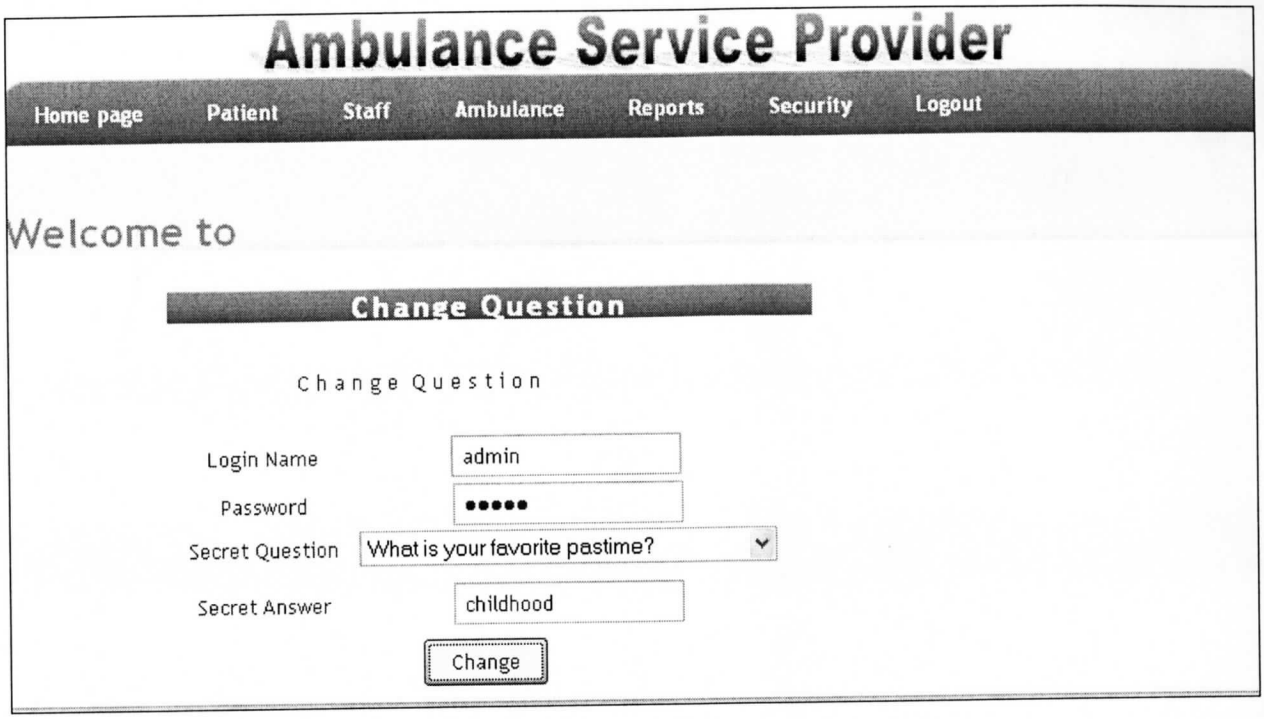

Figure 58: Change Security Question

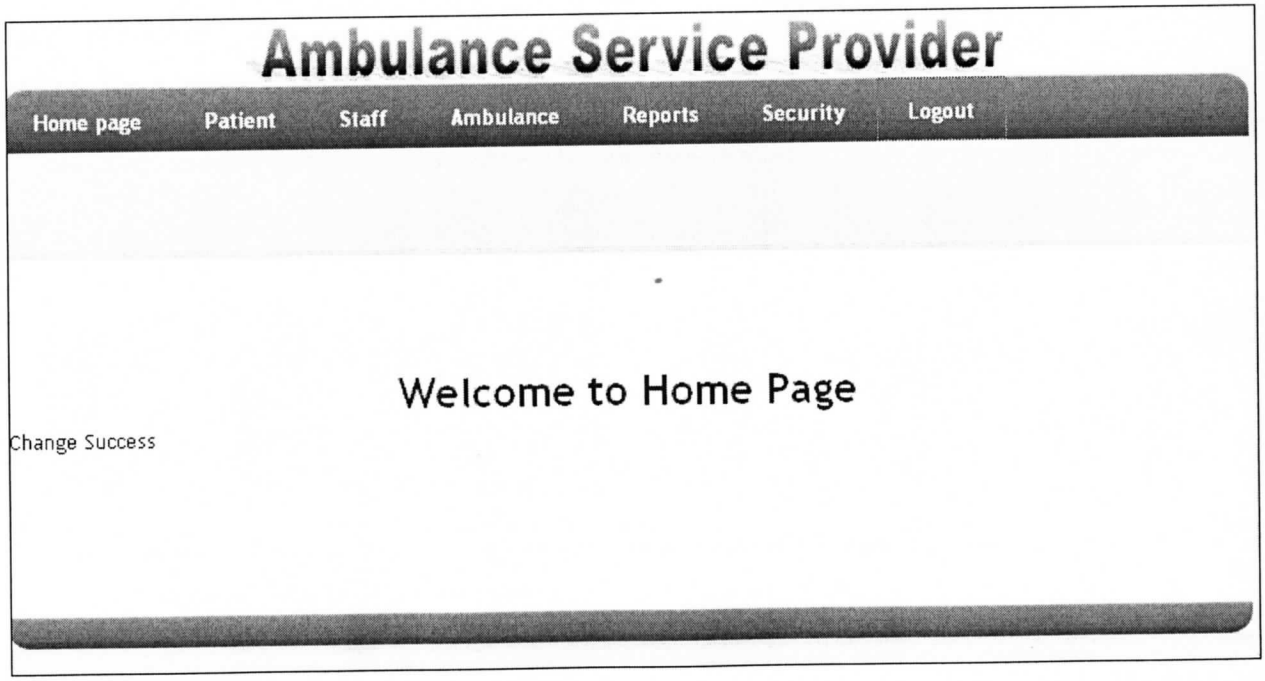

Figure 59: Security Question Change Successful

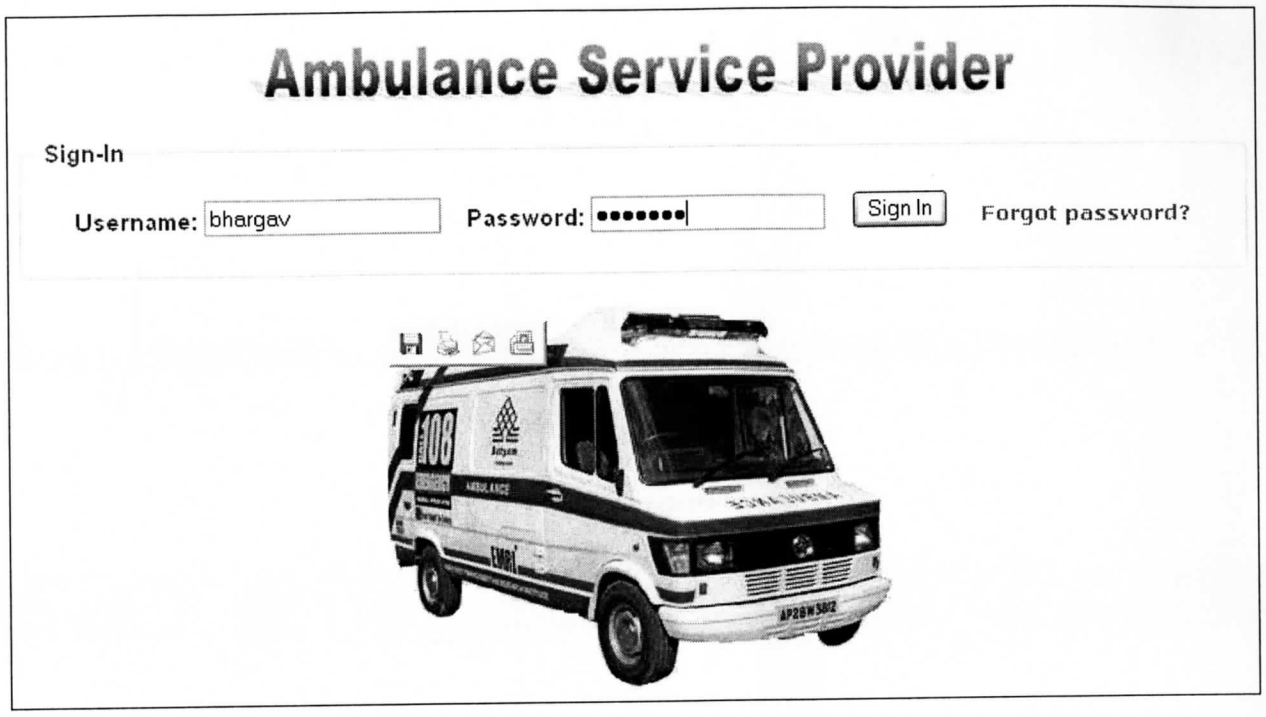

Figure 60: Employee Module Login Page

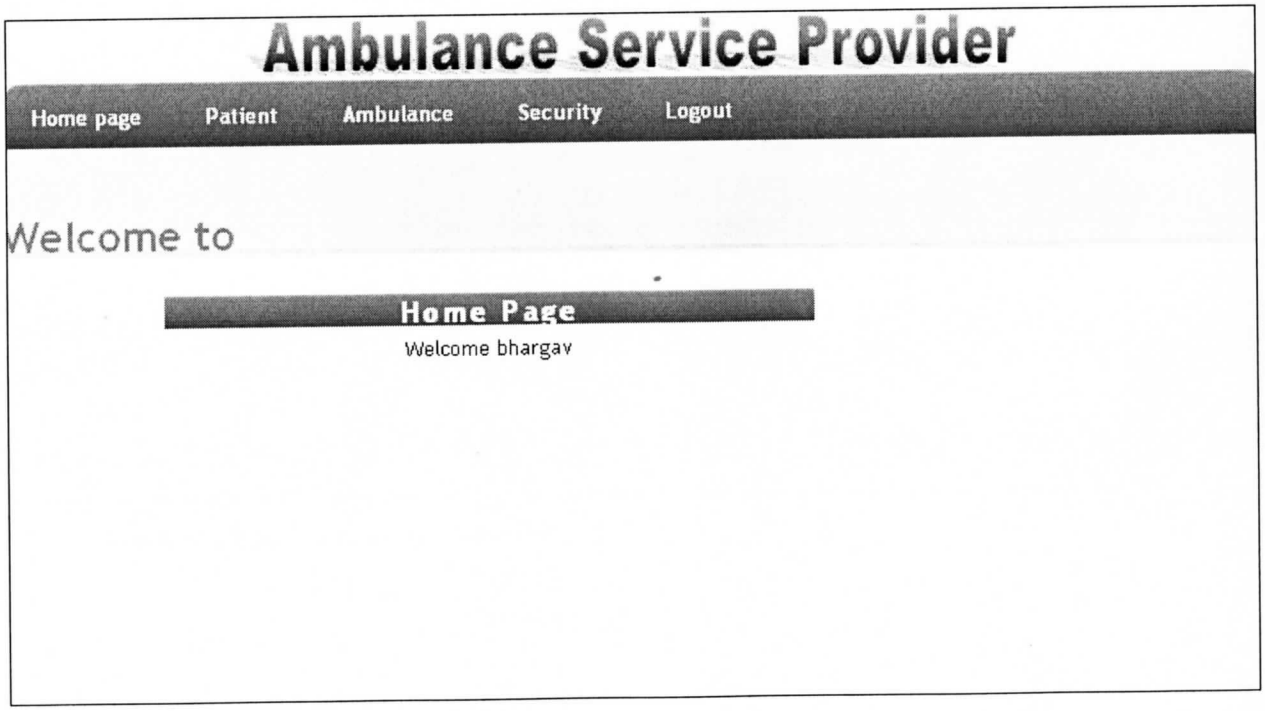

Figure 61: Employee Login Successful

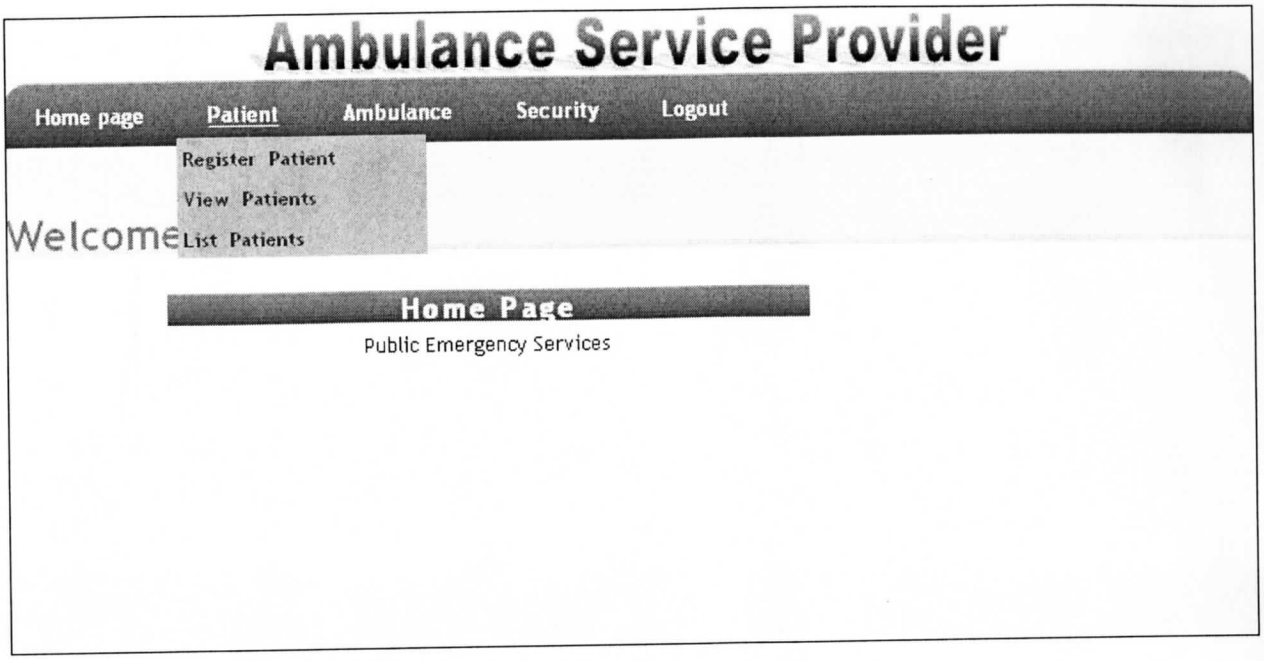

Figure 62: Patient Tab

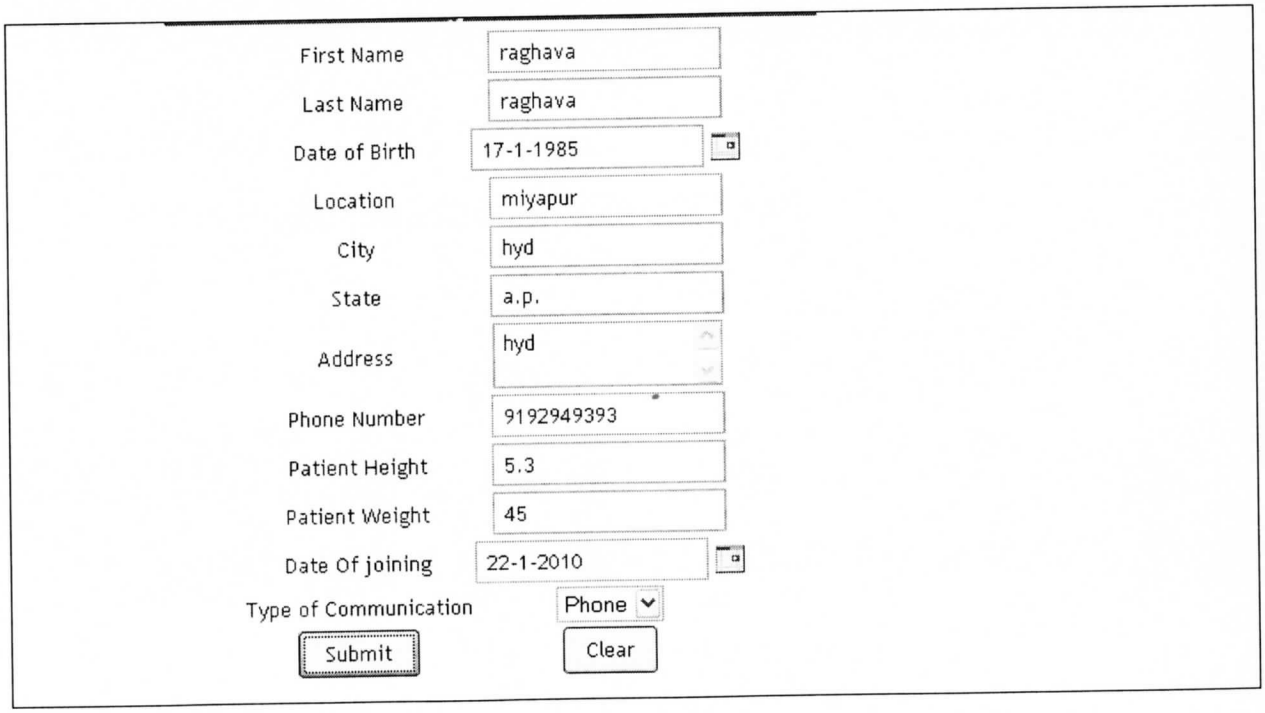

Figure 63: Register Patient

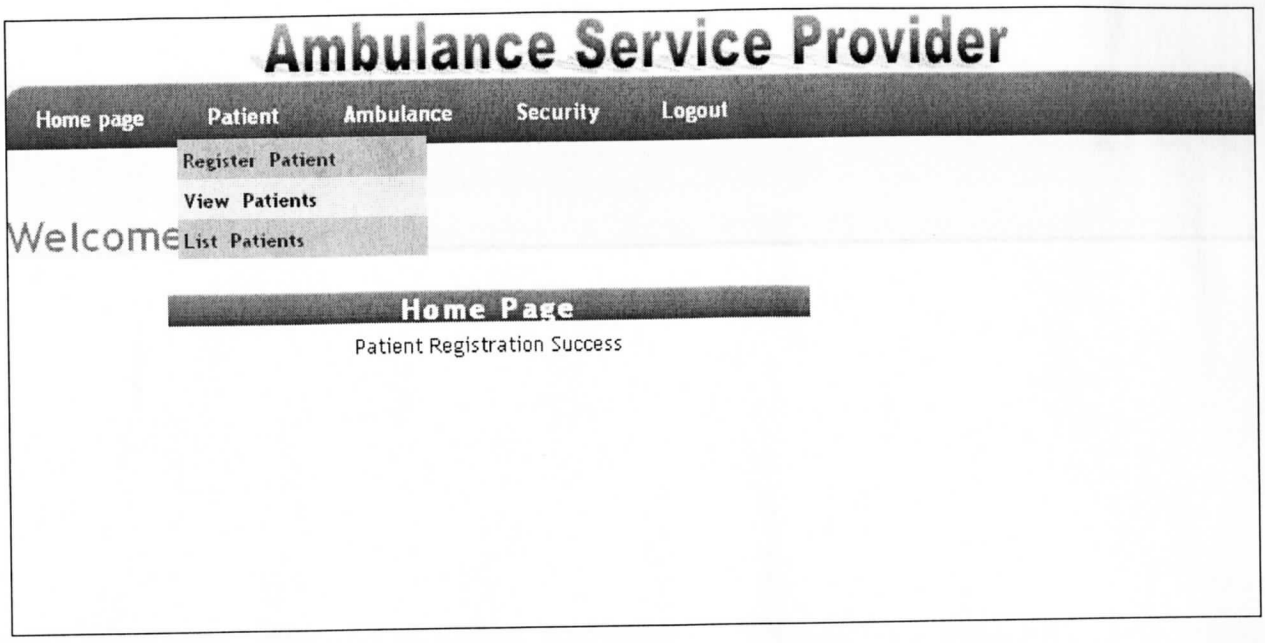

Figure 64: Patient Registration Successful

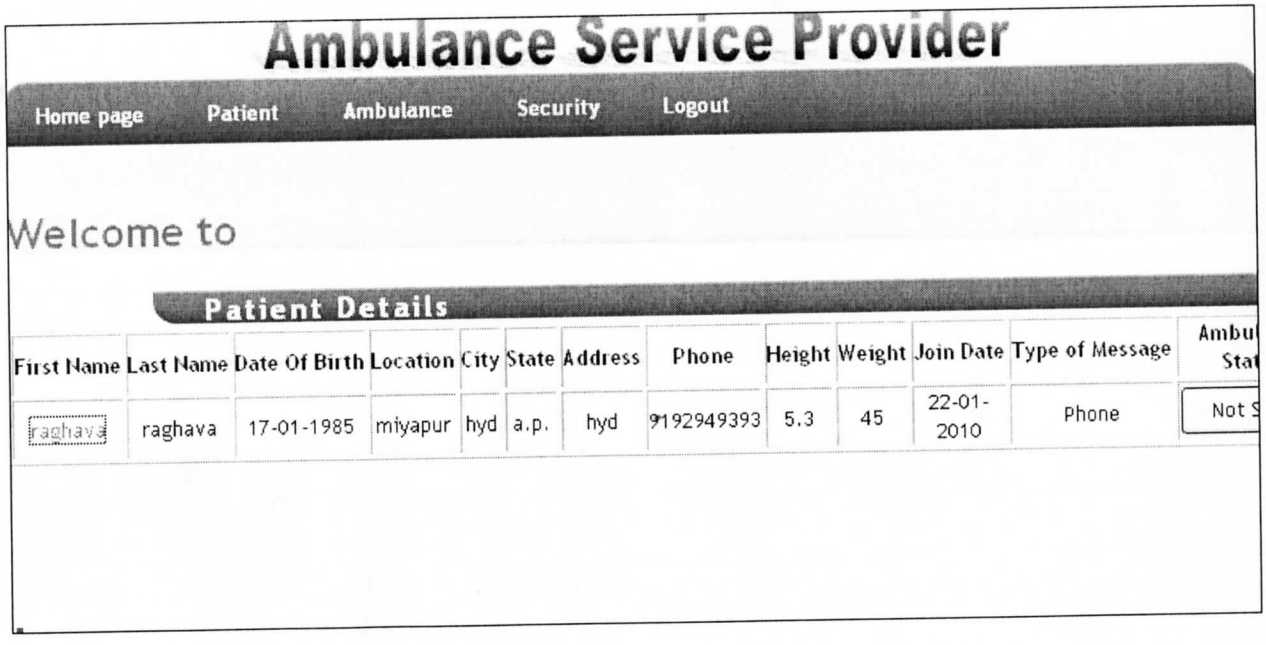

Figure 65: View Patient Details

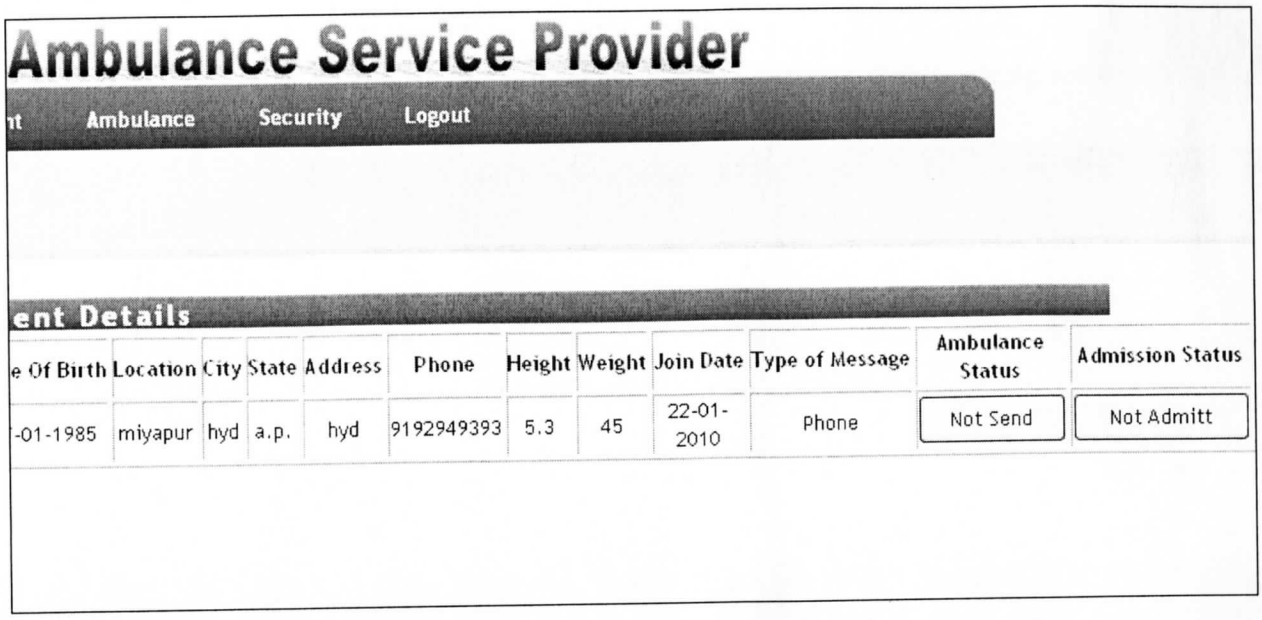

Figure 66: Check Ambulance Status and Patient Admission Status

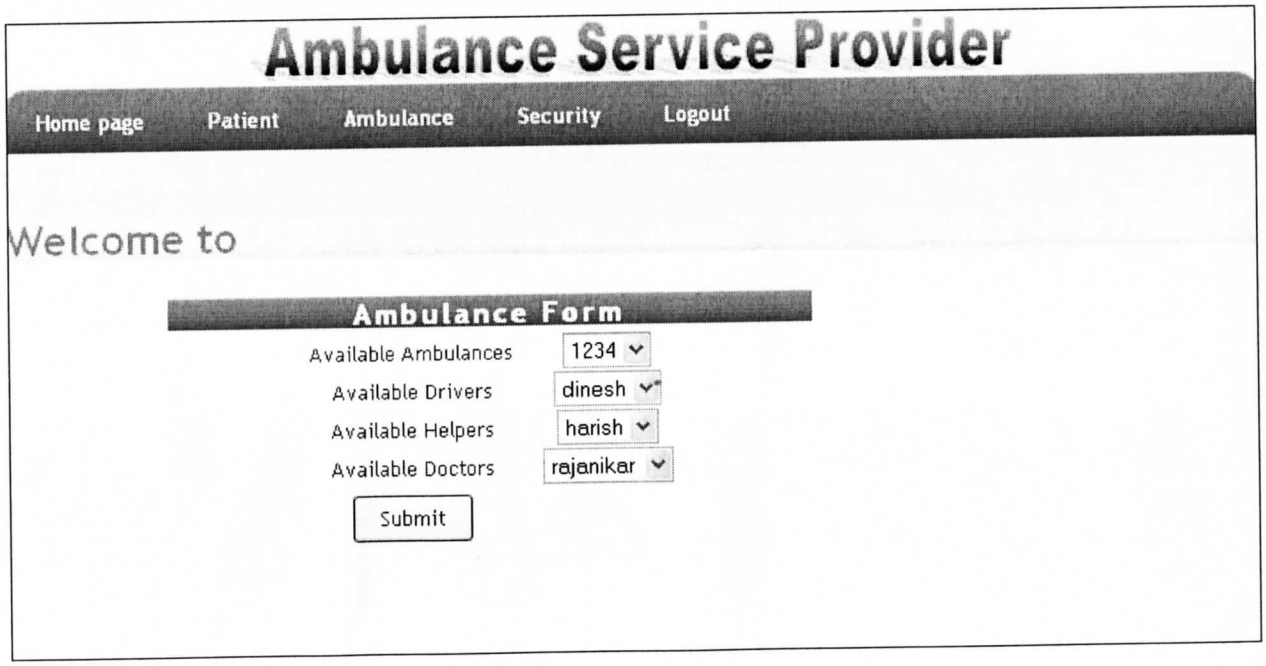

Figure 67: Ambulance Form

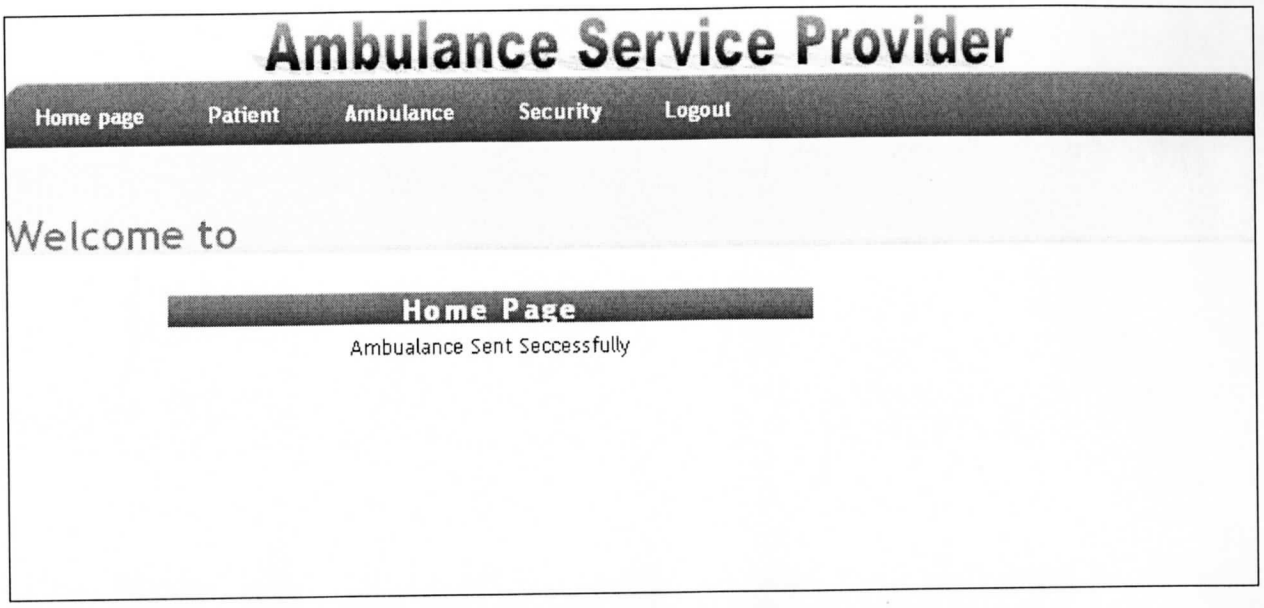

Figure 68: Ambulance Sent Successfully

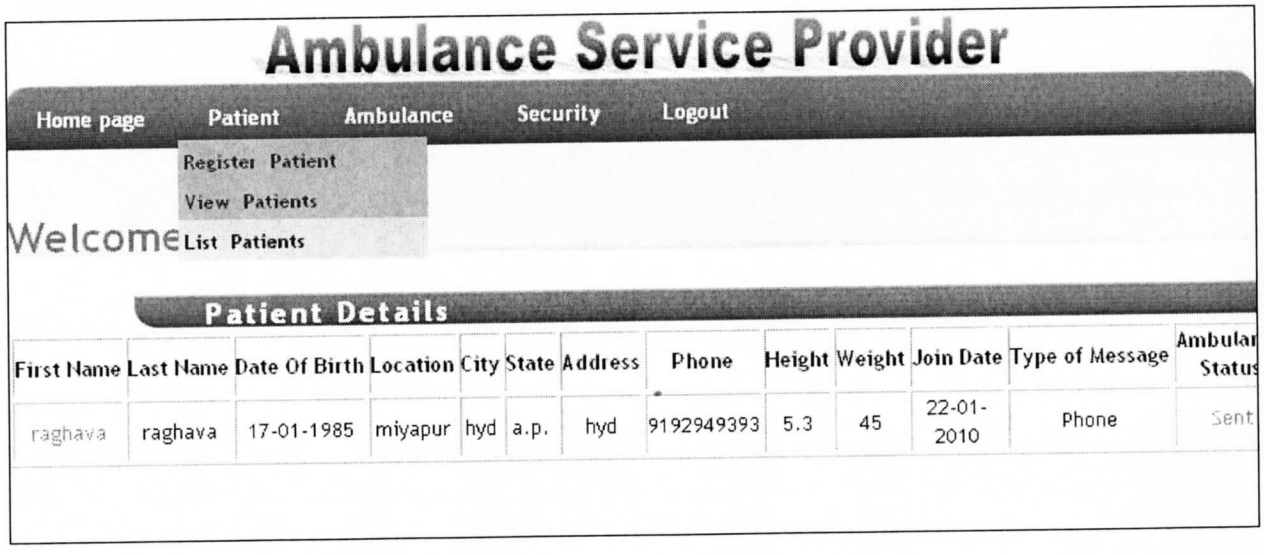

Figure 69: View Patient Details

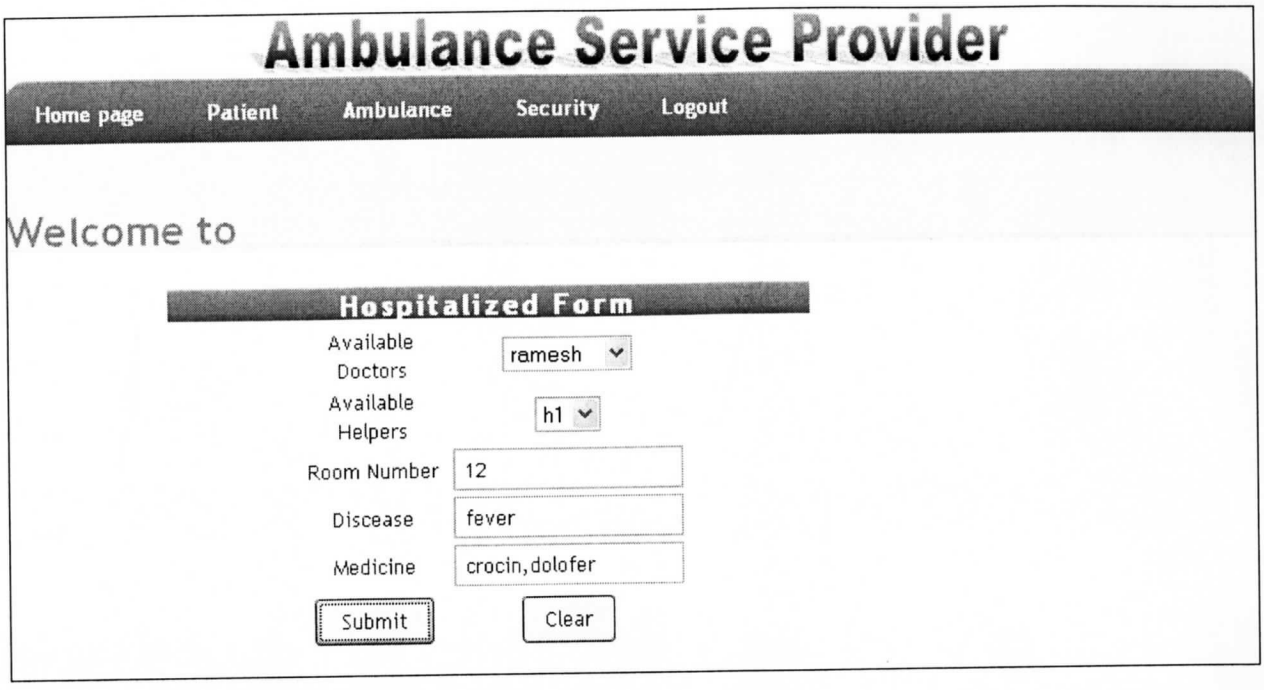

Figure 70: Hospitalized Form

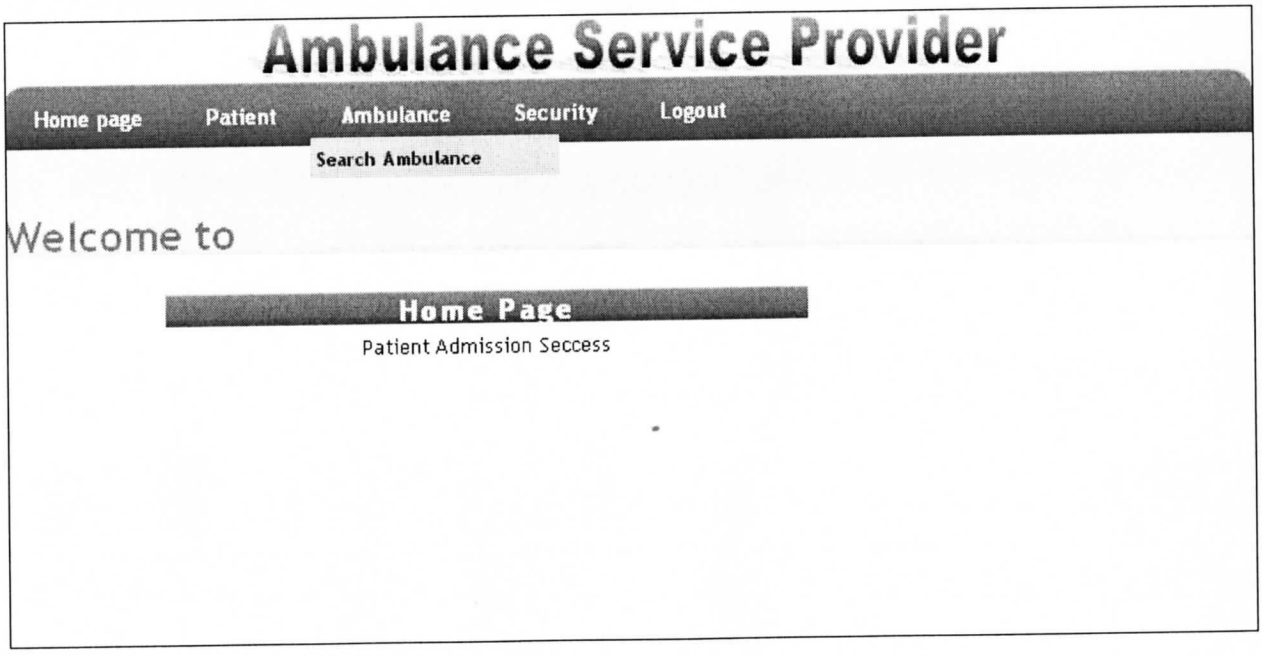

Figure 71: Patient Admission Successful

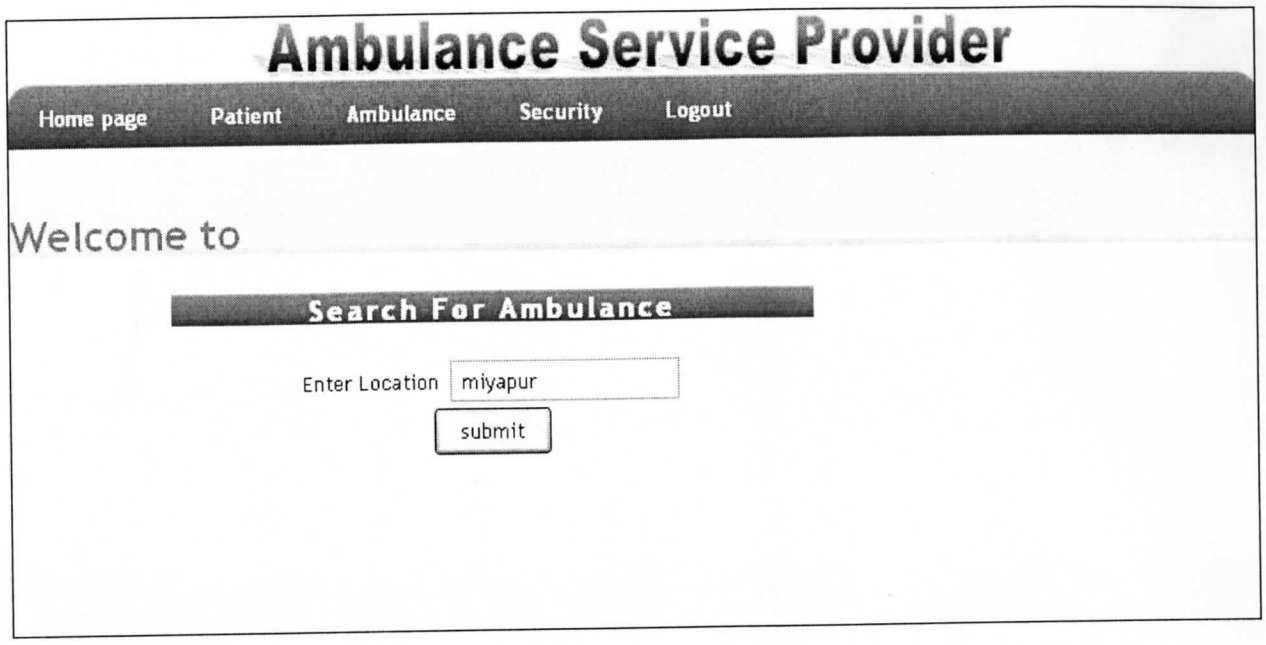

Figure 72: Ambulance Tab/ Search For ambulance at a particular place

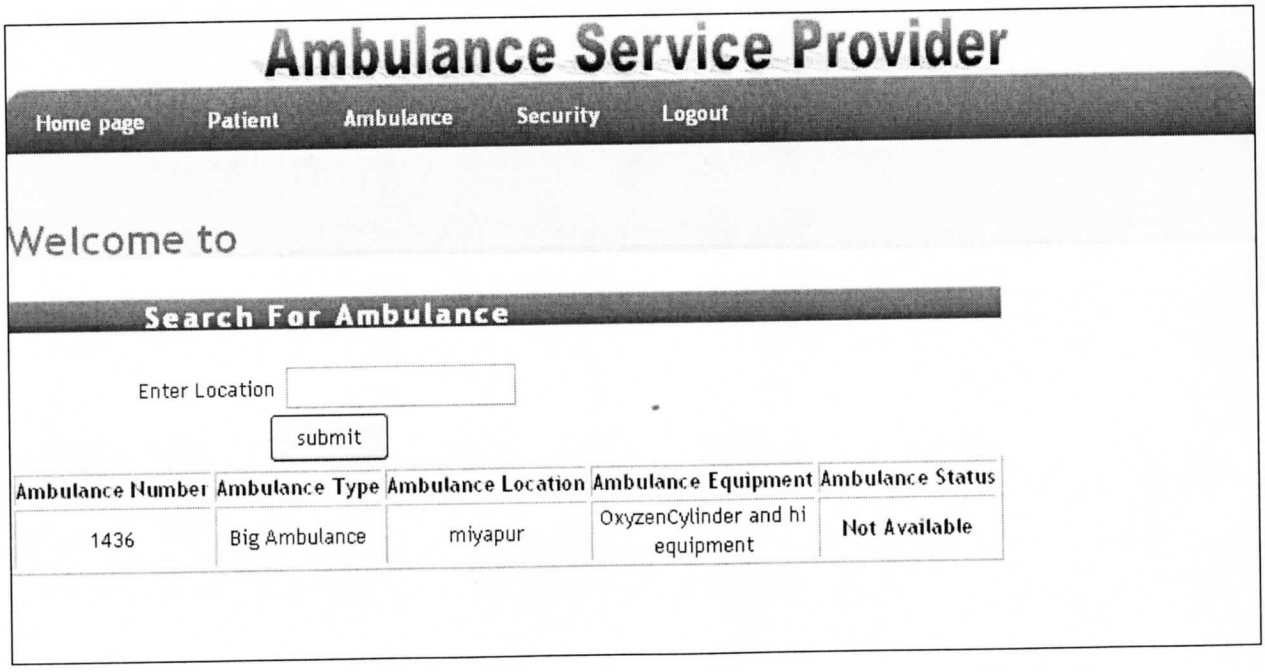

Figure 73: Status of availability of ambulance

Figure 74: Forgot Password

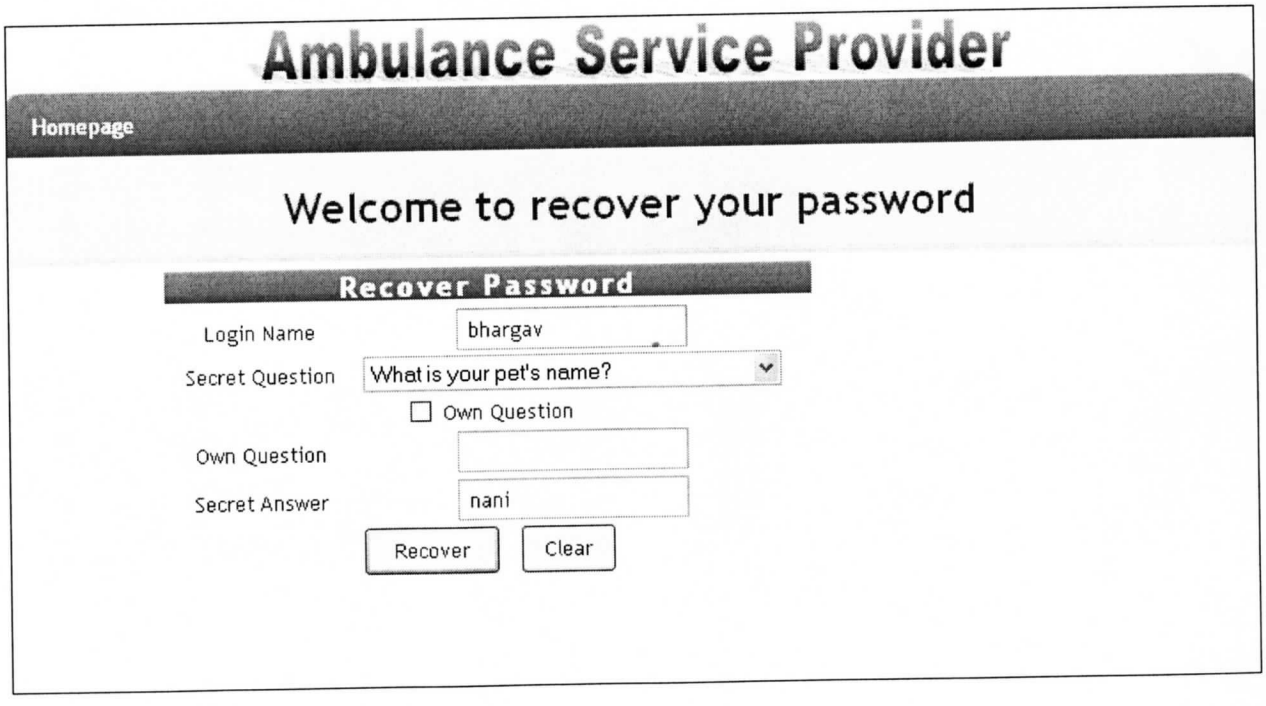

Figure 75: Password Recovery Page

Figure 76: Password Recovered Successfully

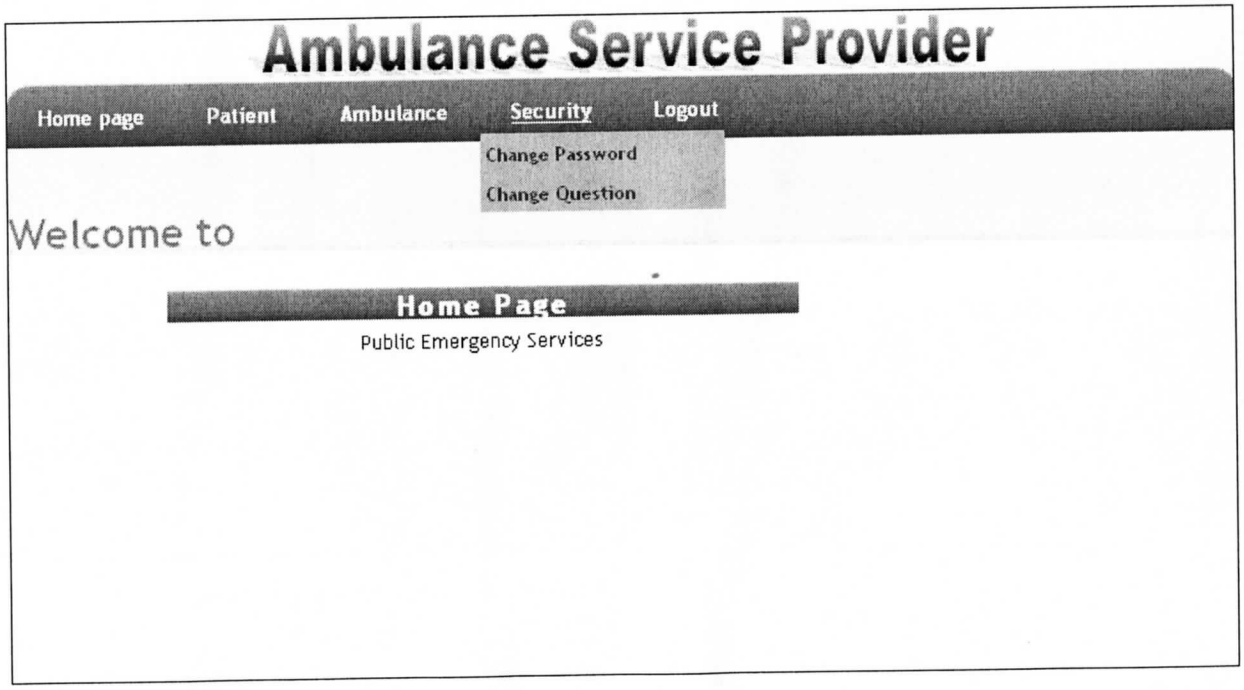

Figure 77: Security Tab

CONCLUSIONS

The application developed as a part of this research is a well-judged application of scientific knowledge used by health care officials following patient preferences and values. It is the process of identifying and using the research solutions systematically. CDSS tools prove to be more efficient and sustainable than generic ones in helping the health care professionals identify the issues easily. The application was thoroughly tested under various conditions with the available testing tools, so that they can easily find the bugs and even implemented best techniques to solve the system troubles if any. Maintaining a newly implemented health care information system is a challenge for any health care organization. The implementation of new information system starts with an implementation team, which will have representatives from key areas in the organization into which this system is going to be implemented. Organizations must provide proper support to health care information systems, to keep up with the current trends. Failing in supporting the newly implemented health care information system will affect the security of the system, increases the response time; also errors and bugs will increase in the system.

As there will be advances in the software's and hardware's for every 2-3 years, the life time of an IT system will be short [1]. So, organizations must provide proper support to health care information systems, to keep up with the current trends. Any of the future implications may include developing a data dictionary. It is an important tool in controlling data quality. There are two types, DBMS data dictionary the one developed at the same time database is developed and the organization wide data dictionary which promotes data consistency throughout the organization. The organization should set up mechanisms and policies that address not only database implementation, but also standards of data quality. The value of combining information systems with clinical applications will result in improved patient services, improved quality of care, improved quality of documentation, less stress and more leisure time.

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APPENDICES

APPENDIX A: EXAMPLE DATA DICTIONARY

Entity types:

1. Name: PATIENT_DISCHARGE_INFO
Type: Strong Entity
Definition: patient's discharge information
Identifier: stateofpatient

2. Name: STAFF_DET
Type: Strong Entity
Definition: Includes details of the staff.
Identifier: sid

3. Name: LOGIN_PROFILE
Type: Strong Entity
Definition: includes login information of a person.
Identifier: loginid

4. Name: AMBULANCE_INFO
Type: Strong Entity
Definition: includes availability information of an ambulance.
Identifier: astatus

5. Name: AMBULANCE_DET
Type: Strong Entity
Definition: includes details of an ambulance.

Identifier: aid

6. Name: PATIENT_DET

Type: Strong Entity

Definition: includes details of the patient.

Identifier: pid

Relationship types:

1. Name: PATIENT_DISCHARGE_INFO to PATIENT_DET

Type: M:1

Description: patient discharge information can include multiple patients details.

2. Name: PATIENT_DET to AMBULANCE_INFO

Type: 1:M

Description: any ambulance can be sent for a patient

ATTRIBUTES:

1. Name: pid

Description: unique identifier of a patient.

Null: No

2. Name: stateofpatient

Description: includes patient discharge information

Null: No

3. Name: dateofdischarge

Description: the date a patient is discharged.

Null: Yes